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ABSTRACT

The career activities guide in mathematics, part of an Idaho State Department of Vocational Education career exploration series for grades 7, 8, and 9, is designed as supplementary material to enrich the regular curriculum. Any one activity in the guide might be used without involving any other activities. The cross-referenced index indicates grades, subject, career cluster, occupation, and, in most instances, subject concept. Performance objectives, activity situation and steps (mainly situational mathematical problems), materials, and special recommendations are outlined for the various job titles. Career clusters included are: home economics and consumer; industrial arts; arts, crafts, and humanities; business occupations; communications and media; hospitality and recreation; environmental control; personal service; manufacturing; transportation; health occupations; public service; agriculture and natural resources; marine science; marketing and distribution; construction; and miscellaneous activities. Subject concepts involve various aspects of science such as fractions, ratios, decimals, equivalent values, ruler measurements, proportions, metric system, percentages, chart reading, scientific notation, exponents, geometry, cost formulas, graph relations, and weights and heights. (EA)

CAREER ACTIVITIES IN MATHEMATICS

GRADES 7·8·9

BOISE SCHOOLS

BOISE IDAHO

PREFACE

The Career Exploration curriculum in this book was developed through a grant from the Idaho State Department of Vocational Education from March 11, 1974 through June 30, 1974. The activities were written by Boise Independent School District personnel.

The activities included are some of the ideas relating to careers which are being used to some degree in many classrooms. It is the purpose of this program to gather and develop many of these ideas and make them available to all seventh, eighth and ninth grade teachers in an integrated format within mathematics, science, language arts and social science.

Any one activity in the book might be used by a teacher or student without involving any other activities. They are designed to enrich the regular curriculum and can be "plugged in" where they seem appropriate. The cross-reference index will indicate grade, subject, career cluster, occupation and, in most instances, subject concept.

ACKNOWLEDGEMENTS

The activities in this guide were developed and written by the following Boise Independent School District personnel:

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DIRECTIONS FOR USE OF THIS GUIDE

The purpose of this guide is to help show relationships between school subjects and practical application through simulated activities. These activities are meant to be an enrichment supplement to the regular school curriculum, taught at those times when the instructor determines they are most applicable to that subject's concepts.

The activities were written to be used in four subject areas; mathematics, science, social sciences and language arts; and in grades seven, eight and nine. The intent is to involve all fifteen occupational cluster areas, as designated by the U. S. Office of Education, with these four subject areas in the three grade levels. They can be used as entire class activities, small group assignments or individual study.

The following pages contain cross-referencing of the activities in this guide:

Activity number with cluster, job and concept reference--pages ii through xiii.

Subject concepts with activity reference number--pages xiv through xvi.

Career Exploration Project
June 30, 1974

SUBJECT MATHEMATICS GRADE 7

#	CLUSTER	JOB AREA	SUBJECT CONCEPT
7 A 1	Home Economics & Consumer	Chef Cook Homemaker	equivalent values
A 2	Home Economics & Consumer	Chef Cook Homemaker	multiplication of fractions
A 3	Home Economics & Consumer	Consumer	ratios, measures
A 4	Home Economics & Consumer	Purchasing Agent	decimals: multiplication, division, subtraction
A 5	Home Economics & Consumer	Butcher	decimals
B 1	Industrial Arts	Electronics Technician	computing voltage
B 2	Industrial Arts	Metal Worker Carpenter Printer	ruler measurements
B 3	Industrial Arts	Carpenter Plumber Any Trade	understanding fractional equivalency

Career Exploration Project
June 30, 1974

SUBJECT MATHEMATICS GRADE 7

#	CLUSTER	JOB AREA	SUBJECT CONCEPT
7 B 4	Industrial Arts	Draftsman Carpenter Metal Worker	fractional values on graphing paper
B 5	Industrial Arts	Plastic Fabrication Sheet Metal Worker	the square inch
B 6		Construction Worker	identification of equivalent volume
C 1	Arts, Crafts, Humanities	Artist	fractions
C 2	Arts, Crafts, Humanities	Artist Painter	geometry
C 3	Arts, Crafts, Humanities	Macrame Artist	proportions, calculation of basic operations
C 4	Arts, Crafts, Humanities	Artist Photographer	proportions
C 5	Arts, Crafts, Humanities	Potter	multiplying decimals, metric system
D 1	Business Occupations	Bank Teller	addition, subtraction

Career Exploration Project
June 30, 1974

SUBJECT MATHEMATICS GRADE 7

#	CLUSTER	JOB AREA	SUBJECT CONCEPT
7 E.	Communications & Media		
F 1	Hospitality & Recreation	Waiter	addition, sum of decimals
G.	Environmental Control		
H 1	Personal Service	Teacher	percentages
I 1	Manufacturing	Physicist, Elect. Engineer	scientific notation, exponents
I 2		Machine Operator	addition of decimals
I 3		Chemical Shop Worker	ratios, concentration of solutions
J 1	Transportation	Airline Pilot	aeronautical chart measurements
K 1	Health Occupations	Medical Doctor	reading charts, ratios
K 2		Operating Room Supervisor	reading charts
L.	Public Service		

Career Exploration Project
June 30, 1974

SUBJECT MATHEMATICS GRADE 7

#	CLUSTER	JOB AREA	SUBJECT CONCEPT
7 M1	Agriculture & Natural Resources	Forester	proportions
N1	Marine Science	Ship's Navigator	chart reading, interpolation
O 1	Marketing & Distribution	Retail Grocery Clerk	division, multiple addition of figures
O 2		Retail Clerk	addition, subtraction
P 1	Construction	Planner Designer Architect	area, volume, scale drawing
Q.	Miscellaneous Activities		

Career Exploration Project
June 30, 1974

SUBJECT MATHEMATICS GRADE 8

#	CLUSTER	JOB AREA	SUBJECT CONCEPT
8 A 1	Home Economics & Consumer	Home Economics Teacher	decimals, multiplication, division, addition
A 2	Home Economics & Consumer	Consumer Purchasing Agent	percentages
A 3	Home Economics & Consumer	Homemaker Purchasing Agent	decimals
A 4	Home Economics & Consumer	Seamstress	fractions, multiplication, decimals
A 5	Home Economics & Consumer	Novelty Seamstress	fractions: addition, subtraction, multiplication
B 1	Industrial Arts	Carpenter	fraction equivalency
B 2	Industrial Arts	Electronics Technician	voltage & current in a simple circuit
B 3	Industrial Arts	Carpenter Architect Homebuilder	multiplication & division of decimals

SUBJECT MATHEMATICS GRADE 8

#	CLUSTER	JOB AREA	SUBJECT CONCEPT
8 B 4	Industrial Arts	Architect Sheet Metal Worker	ratio & proportions
B 5	Industrial Arts	Carpenter, Metal Worker	division of fractions
B 6		Carpenter	metric system, conversion
C 1	Arts, Crafts, Humanities	Macrame Artist	proportions, basic operation, percentage
C 2	Arts, Crafts, Humanities	Fine Artist	measurements with a ruler
C 3	Arts, Crafts, Humanities	Fine Artist	construction of a large circle
C 4	Arts, Crafts, Humanities	Advertising Designer	proportion
C 5	Arts, Crafts, Humanities	Potter	determining percentage
D 1	Business Occupations	Auctioneer Rancher Salesyard Manager	percentages

SUBJECT MATHEMATICS GRADE 8

#	CLUSTER	JOB AREA	SUBJECT CONCEPT
8 E.	Communications & Media		
F 1	Hospitality & Recreation	City Recreation Director	problem solving
G.	Environmental Control		
H 1	Personal Service	Barber	decimals & percentages
H 2		Cosmetologist	percentage
I 1	Manufacturing	Chemist	ratios, solutions,
I 2		Physicist, Elect. Engineer	scientific notation, exponents
J 1	Transportation	Airline Pilot	chart measurements, speed-time computation
K 1	Health Occupations	Doctor	ratios, functions
K 2		Lab Technician	percent concentration, ratios
L.	Public Service		

Career Exploration Project
June 30, 1974

SUBJECT MATHEMATICS GRADE 8

#	CLUSTER	JOB AREA	SUBJECT CONCEPT
8 M 1	Agriculture & Natural Resources	Nurseryman	percentage
N 1	Marine Science	Ship's Navigator	angle measures, latitude
O 1	Marketing & Distribution	Salesperson	simple percentages
P 1	Construction	Architect, Designer, Planner	area, volume, scale drawing
P 2		House Painter	area, decimals, measurement
Q.	Miscellaneous Activities		

Career Exploration Project
June 30, 1974

SUBJECT MATHEMATICS GRADE 9

#	CLUSTER	JOB AREA	SUBJECT CONCEPT
9 A 1	Home Economics & Consumer	Home Economics Teacher Consumer	conversion to metric system
A 2	Home Economics & Consumer	Home Economics Teacher Consumer	conversion to metric system
A 3	Home Economics & Consumer	Homemaker Restaurant Cook	multiplication of fractions
A 4	Home Economics & Consumer	Consumer	percents, decimals
A 5	Home Economics & Consumer	Retail Buyer	math skills
A 6		Homemaker	computation of costs using formulas
B 1	Industrial Arts	Diesel Mechanic Automotive Engineer	ratios, functions
B 2	Industrial Arts	Electronics Technician	graph relations, functions
B 3	Industrial Arts	Power Mechanic	geometry, volume of a cylinder

Career Exploration Project
June 30, 1974

SUBJECT MATHEMATICS GRADE 9

#	CLUSTER	JOB AREA	SUBJECT CONCEPT
9 B 4	Industrial Arts	Pow.. Mechanic	geometry, placement of values into a formula
B 5	Industrial Arts	Carpenter	geometry
B 6		Diesel Mechanic, Mech.Eng.	ratios, functions
C 1	Arts, Crafts, Humanities	Fine Artist	using a ruler, angles, construction
C 2	Arts, Crafts, Humanities	Potter	percentage
C 3	Arts, Crafts, Humanities	Delineator	proportion
C 4	Arts, Crafts, Humanities	Macrame Artist	proportion, percentage
C 5	Arts, Crafts, Humanities	Potter	division of percentage
D 1	Business Occupations	Banker	percentages, multiplication, addition, division

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SUBJECT MATHEMATICS GRADE 9

#	CLUSTER	JOB AREA	SUBJECT CONCEPT
9 E.	Communications & Media		
F 1	Hospitality & Recreation	Hotel Manager	percentage
G.	Environmental Control		
H.	Personal Service		
I 1	Manufacturing	Chemist	ratios, rates & flow
I 2		Physicist, Elect. Engineer	exponents, scientific notation
J 1	Transportation	Airline Pilot	speed, distance, time, vector additions
J 2		Astronaut, Physicist, Engin.	proportion, inverse proportion, power, functions
J 3		Astronaut	square roots, functions, exponents, ratios
K 1	Health Occupations	Doctor	proportions & functions
K 2		Laboratory Technician	ratios, percents
L 1	Public Service	License Clerk	percentage
L 2		Deputy Sheriff	weights & heights

Career Exploration Project
June 30, 1974

SUBJECT MATHEMATICS GRADE 9

#	CLUSTER	JOB AREA	SUBJECT CONCEPT
9 M 1	Agriculture & Natural Resources	Wheat Farmer	computation & percentage
N 1	Marine Science	Ship's Navigator	analytic geometry
N 2		Ship's Navigator	geometry, time & angle measures
O 1	Marketing & Distribution	Retail Clerk	addition, simple percentage
O 2		Salesperson	simple percentage
P 1	Construction	Homeowner	volumes, simple algebra
P 2		Architect, Civil Engineer	area, volume, scale drawing
Q.	Miscellaneous Activities		

MATHEMATICS CONCEPTS

CONCEPT	ACTIVITY NUMBER		
	Grade 7	Grade 8	Grade 9
1. Addition	7D, 7F, 7I^{2}, 7O^{1}, 7O^{2}	8A^{1}, 8A^{5}	9D, 9O^{1}
2. Algebra			
3. Analytic Geometry			9N^{1}
4. Area	7P	8P^{1}, 8P^{2}	
5. Charts	7J^{2}, 7K^{1}, 7K^{2}, 7N	8J	
6. Decimals	7A^{4}, 7A^{5}, 7C^{5}, 7F, 7I^{2}	8A^{1}, 8A^{3}, 8A^{4}, 8B^{3}, 8H^{1}, 8P^{2}	9A^{4}
7. Division	7A^{4}, 7O^{1}	8A^{1}, 8B^{3}, 8B^{5}	9C^{5}, 9D
8. Equivalent Volume & Values	7A^{1}, 7B^{6}		
9. Exponents	7I^{1}	8I^{2}	9I^{2}, 9J^{3}
10. Formulas			9A^{6}, 9B^{4}
11. Fractional Equivalency	7B^{3}	8B^{1}	

(continued)

CONCEPT	ACTIVITY		
	Grade 7	Grade 8	Grade 9
12. Fractions	7A[2], 7C[1]	8A[4], 8A[5], 8B[5]	9A[3]
13. Geometry	7C[2]	8C[3], 8N	9B[3], 9B[4], 9B[5], 9N[2]
14. Graphing	7B[4]		9B[2]
15. Interpolation	7N		
16. Inverse Proportion			9J[2]
17. Metric System	7C[4]	8B[6]	9A[1], 9A[2]
18. Multiplication	7A[2], 7A[4], 7C[5], 7O[1]	8A[1], 8A[5], 8B[3]	9A[3], 9D
19. Percentages	7H	8A[2], 8C[1], 8C[5], 8D, 8H[2], 8K[2], 8M, 8O	9A[4], 9C[2], 9C[4], 9D, 9F 9K[2], 9L[1], 9M, 9O[1], 9O[2]
20. Problem-Solving		8F	
21. Proportions	7C[3], 7C[4], 7M	8B[4], 8C[1], 8C[4]	9C[3], 9C[4], 9J[2], 9K[1]
22. Ratios	7A[3], 7J[1], 7K[1]	8B[4], 8I[1], 8K[1], 8K[2]	9B[1], 9B[6], 9I[1], 9J[3] 9K[2]
23. Ruler Measurements	7B[2]	8C[2]	9C[1]

(continued)

CONCEPT	ACTIVITY		
	Grade 7	Grade 8	Grade 9
24. Scale Drawing	7P	8P[1]	9P[2]
25. Scientific Notation	7I[1]	8I[2]	9I[2]
26. Square Inch	7B[5]		
27. Square Root			9J[3]
28. Subtraction	7A[3], 7D, 7O[2]		9B[3], 9P[1], 9P[2]
29. Volume	7P		9B[3], 9P[1], 9P[2]
30. Weights & Measures			9L[2]

CLUSTER AREAS

The clusters used in this curriculum guide are those designated by the U. S. Office of Education plus one additional in Industrial Arts. The first three; Home Economics and Consumer Education; Industrial Arts; and Arts, Crafts and Humanities; each have five or more activities; whereas, the remaining clusters average one. One of the objectives of the project is to show more practical relationships between school subjects as well as subjects and occupations. This is the reason for the emphasis on the first three clusters which are also subject areas in the junior high years.

The clusters used in this curriculum for all three grade levels are:

a) Home Economics and Consumer Education
b) Industrial Arts
c) Arts, Crafts and Humanities
d) Business Occupations
e) Communications and Media
f) Hospitality and Recreation
g) Environmental Control
h) Personal Services
i) Manufacturing
j) Transportation
k) Health Occupations
l) Public Services
m) Agriculture and Natural Resources
n) Marine Science
o) Marketing and Distribution
p) Construction

CAREER EXPLORATION ACTIVITIES

CLUSTER AREAS	NUMBER OF ACTIVITIES BY SUBJECT AREA AND GRADE LEVEL												TOTAL
	MATHEMATICS			SCIENCE			LANGUAGE ARTS			SOCIAL SCIENCE			
	7	8	9	7	8	9	7	8	9	7	8	9	
A CONSUMER AND HOME ECONOMICS	5	6	5	2	6	5	7	4	5	3		5	53
B INDUSTRIAL ARTS	6	6	6	3	6	5	4	4	4	7	5	6	62
C ARTS, CRAFTS AND HUMANITIES	5	5	5	5	3	4	6	5	4	5		6	53
D BUSINESS OCCUPATIONS	1	1	1		1	2	1	3	2	1	1	1	15
E COMMUNICATIONS AND MEDIA					1	1	2	2	2	1	1	3	13
F HOSPITALITY AND RECREATION	1	1	1			1	1	1	1	1	1	1	10
G ENVIRONMENTAL CONTROL				1	1	1	2	1	1	1		1	9
H PERSONAL SERVICE	1	2			1	1	3	2	1	2	1	1	15
I MANUFACTURING	3	2	2		1	2		1	1	2		1	15
J TRANSPORTATION	1	1	3		1	1	2	1	1		2	2	15
K HEALTH OCCUPATIONS	2	2	2	3	3	1	1	2	1	1	2	1	21
L PUBLIC SERVICE			2		1	1	3	5	2	1	1	4	20
M AGRICULTURE AND NATURAL RESOURCES	1	1	1		2	1	2	1	1	3	1	3	17
N MARINE SCIENCE	1	1	2		1	1	1		1	1	1	3	13
O MARKETING AND DISTRIBUTION	2	1	2		1	1	2	1	2	1		2	15
P CONSTRUCTION	1	2	2		1	1	1	1	1			2	12
Q MISCELLANEOUS							2	1					3
TOTALS	30	31	34	14	30	29	40	35	30	30	16	42	361

APPENDIX A

CODE 7-A-1

SUBJECT Math

CLUSTER Home Economics

JOB TITLE Bakery Chef
Restaurant Cook
Homemaker

CONCEPT

Equivalent Values

PERFORMANCE OBJECTIVE

The student will learn common weight and measure equivalency. Given a measurement in one terminology, he should be able to rewrite it in another term.

ACTIVITY

I. SITUATION

The student is a restaurant cook who must enlarge basic recipes. Once the recipes are enlarged, the measures may be written in simpler terms. For example: four tablespoons is the same as one-fourth cup, four cups is the same as one quart. When measuring amounts of ingredients, it is easier to measure a single large amount than many smaller amounts.

II. STEPS

1) Study the equivalent measures and weights below:

a) 3 tsp = 1 T
b) 2 T = 1 fluid ounce
c) 4 T = ¼ cup
d) 8 T = ½ cup
e) 12 T = 3/4 cup
f) 16 T = 1 cup
g) 1 cup = 8 fluid ounces
h) 2 cups = 1 pint
i) 4 cups = 1 quart
j) 4 quarts = 1 gallon
k) 4 ounces = ¼ pounds
l) 16 ounces = 1 pound

2) Write the measures below in the simplest equivalent amount.

a) 6 tsp = _____

b) 4 cups = _____

c) 18 T = _____

d) 6 cups = _____

RECOMMENDATIONS

Cookbooks should be available for references.

MATERIALS

Measuring spoons
Measuring cups

MATERIALS

GRADE 7-A-1

SUBJECT Math

CLUSTER Home Economics

JOB TITLE Bakery Chef
Restaurant Cook
Homemaker

e) 5 tsp = _____

f) 9 T = _____

g) 3 pints = _____

h) 12 fluid ounces = _____

i) 6 ounces = _____

j) 24 ounces = _____

3) Have the students use measuring cups and spoons to see if the equivalency chart above is accurate.

DE 7-A-2

SUBJECT Math

CLUSTER Home Economics

JOB TITLE Bakery Chef
Restaurant Cook
Homemaker

CONCEPT

Multiplication of fractions and whole numbers.

PERFORMANCE OBJECTIVE

The student when given a standard recipe will be able to double, triple, halve, etc. it.

ACTIVITY Page 1 of 2

I. SITUATION

A common situation many chefs are confronted with is enlarging recipes to serve many people. The recipe below, for Swiss Steak, serves six. If a party of twenty-four people is expected, the chef must enlarge the recipe four times.

Example: Swiss Steak

2½ lbs round steak
¼ C flour
1 tsp salt
⅛ tsp pepper
2 T salad oil
1 large onion
1 stalk celery
2 C cooked tomatoes

Enlarged recipe:

$4(2\frac{1}{2})$ lbs steak = $4 \times \frac{5}{2}$ = 10 lbs steak

4(¼) flour = 1 C flour
4(1tsp) salt = 4 tsp salt
4(⅛tsp) pepper = 1 tsp pepper
4(2T) salad oil = 8 T oil
4(1) large onion = 4 onions
4(1) stalks celery = 4 stalks
4(2C) tomatoes = 8 C tomatoes

II. STEPS

1) Given the following recipe for fudge, (a) double the original recipe (b) halve the original recipe and (c) triple the original recipe.

RECOMMENDATIONS

Teachers should work examples of doubling, halving, tripling, four times a number, etc.

MATERIALS

Example cookbooks

MATERIALS

ADE 7-A-2

SUBJECT Math

CLUSTER Home Economics

JOB TITLE Bakery Chef
Restaurant Cook
Homemaker

FUDGE

3 C sugar
¼ tsp salt
½ C sifted unsweetened cocoa
1 C milk
2 T corn syrup
3 T butter
1 tsp vanilla
1 C chopped nuts

2) Given the following recipe for macaroni and cheese, (a) triple the original recipe (b) one and a half times the original recipe (c) halve the original recipe.

MACARONI & CHEESE

½ C butter
1 8 ounce package macaroni
1 tsp salt
¼ tsp pepper
1/8 tsp oregano
¼ tsp dry mustard
2 C water
1½ T flour
14½ ounces canned milk
2 C sharp cheddar cheese
1 T parsley

E 7-A3

SUBJECT Math

CLUSTER Home Economics

JOB TITLE Consumer

CONCEPT

1) Ratios
2) Measures

PERFORMANCE OBJECTIVE

The student will be able to calculate the amount of oil and gasoline required to operate an outboard motor for a ski boat, with 80% accuracy determined by testing on data furnished by the teacher.

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ACTIVITY

I. SITUATION

The student is a boat owner. He needs to mix gasoline and oil in the proper ratio to keep the motor operating properly. The Owner's Manual states that for normal operation the ratio of gasoline to oil should be 50 to 1. For the 25-hour break-in period, the mixture should be 25 to 1.

II. STEPS

Assume that you will use two standard six-gallon gas tanks and you purchase your outboard motor oil in one-pint containers.

1) Calculate how much oil should be used for a 50/1 ratio to fill a six-gallon tank.

2) Calculate the same for a 25/1 ratio.

---

1) 1/51 X 6 = 6/51 gallons oil = 24/51 qt. oil = 48/51 pint oil ≈ 1 pt. - 50/1 ratio

2) 1/26 X 6 = 3/13 gallons oil = 12/13 qt. oil = 24/13 pint oil ≈ 1 qt. - 25/1 ratio

On practical operation, most boat owners simply add one pint of oil to a tank of gas for 50/1 ratio and 1 quart of oil to a tank of gas for a 25/1 ratio.

RECOMMENDATIONS

Recommend a three-day field trip to teach class to water-ski.

MATERIALS

Weights and measures table

MATERIALS

GRADE 7-A4

SUBJECT Math

CLUSTER Home Economics

JOB TITLE Purchasing Agent

CONCEPT

(1) Decimals - Division - Multiplication
(2) Subtraction Decimals

PERFORMANCE OBJECTIVE

Given a group pricing for a type of item, a student will be able to find

(a) the cost per item
(b) compare the cost per item to a single item price

RECOMMENDATIONS

Bring to class can labels or boxes with prices.

ACTIVITY Page 1 of 2

I. SITUATION

The student is a purchasing agent who is comparing the prices of group item buying to single item prices. He will first determine the price of single item out of a group purchase price and then determine the better buy.

Example: Peas are advertised as 3 cans/82¢

Price per can = $3\overline{)82} = .273$ Round off to nearest penny.

6
22
21
10 = $ .27 per can

II. STEPS

1) Study the store advertisements concerning foods. Make a list of at least ten items that are group priced.

2) Figure the price of a single item from the lis in (1).

3) Compare the price lists on the next page for the two grocery stores "A" and "B". State which store gives the better buy. How much savings is there?

MATERIALS

Roomset: newspaper ads

MATERIALS

CODE 7-A4

SUBJECT Math

CLUSTER Home Economics

JOB TITLE Purchasing Agent

ACTIVITY

ITEM	A	B	BEST BUY	SAVINGS
Hamburger Helper	$ .56	2/$1.08		
Lettuce	3/$1.00	$.35/head		
Eggs (Small)	2/$.89	.42		
Candy Bars	2/$.25	.17		

GRADE 7-A-5

SUBJECT Math

CLUSTER Home Economics

JOB TITLE Butcher

CONCEPT

Decimals

PERFORMANCE OBJECTIVE

Given the weight of a steer before butchering, the students will figure the cost per pound for the meat after it is butchered.

RECOMMENDATIONS

Field trip to livestock auction or butcher shop.

ACTIVITY

I. SITUATION

A butcher purchases a steer at the livestock auction which weighs 1000 pounds for $.51 a pound. He paid $20 to have the steer killed and quick frozen Weighing the meat after this, he had only 500 pounds of meat. How much does the meat cost him per pound?

II. STEPS

1) How much does the steer originally cost the butcher? (Add in the $20)

2) Divide the amount found in (1) to figure the cost per pound of 500 pounds of meat.

3) A pig weighs 225 pounds before being butchered. A butcher buys it for $.42 a pound plus $15 for killing, freezing and cutting it up. If there is only 140 pounds of cured meat, what is the actual cost per pound?

MATERIALS

MATERIALS

SUBJECT Math

CLUSTER Industrial Arts

JOB TITLE Electronics Technician

CONCEPT

Compute Voltage, current and power requirements of a simple circuit.

PERFORMANCE OBJECTIVE

The student will be able to calculate voltage, current, and power requirements of simple circuits with known voltage and resistance 80% of the time with data furnished by the instructor.

ACTIVITY

I. SITUATION

You are an Electronics Technician in an industrial plant. You have a battery, a set of resistors of known resistance, a volt meter and an ammeter. You measure the voltage of the battery and the current through one resistor with an ammeter when your boss tells you that they need your ammeter immediately at Cape Kennedy for the next space shot. You decide that you "can carry on" without this meter because you have confidence in your own ability to predict the current in the resistors. How can you do it?

II. STEPS

1) $E = I \times R$ where E is the voltage, I = current in amperes and R = resistance in ohms. For your first resistor, R_1, measure the voltage across the resistor and the current through it.

2) For the other resistors, R_2, R_3,... predict the value of current, I, that will result and verify with the ammeter. Keep track of you actual meter readings and predictions (suggested form on the following page).

3) Now use $P = I^2R$ where P = power in watts, to determine how much power is being consumed in the resistor.

4) Find the resistance of and power comsumed by a bell and a light bulb by measuring the current through them. $\left(R = \frac{E}{I}\right)$

RECOMMENDATIONS

MATERIALS

Set of 4 or 5 resistors with predetermined resistances, 1 6-volt battery, 1 volt-ammeter, 1 6-volt light bulb, 1 6-volt bell

MATERIALS

GRADE 7-B /

SUBJECT Math

CLUSTER Industrial Arts

JOB TITLE Electronics Technician

(continued)

ACTIVITY

Voltage _____

Resistance	Predicted Current	Measured Current	Predicted Power (use measured current)
R_1 = ohms			
R_2 = ohms			
R_3 = ohms			
Bell			
Bulb			

E 7-B 2

SUBJECT Math

CLUSTER Industrial Arts

JOB TITLE Metal Worker
Carpenter
Printer

CONCEPT

Measurement with a rule to the nearest sixteenth of an inch.

PERFORMANCE OBJECTIVE

The student will be able to measure any object to the nearest sixteenth of an inch. Exact measurement is a necessity 100% of the time.

ACTIVITY

I. SITUATION

The student is a carpenter who is renovating an old table. He must be able to measure the length and width of the table to the exact sixteenth of an inch. The degree of accuracy of the measurement depends on the scale used.

II. STEPS

1) Each student will have a three-foot rule.

2) Each student will measure the length, width and height of his/her desk. Measure the distance to the nearest sixteenth of an inch.

3) Next, have the students measure the dimensions of the teacher's desk. Have the students compare their measurements.

4) Have the students measure the length and width of the room's windows. Compare measurements.

RECOMMENDATIONS

MATERIALS

Classroom set of three-foot rulers,
Reference: Metalworks, page 198.

MATERIALS

GRADE 7-B 3

SUBJECT Math

CLUSTER Industrial Arts

JOB TITLE Any trade
Carpenter
Plumber

CONCEPT

In connection with measurement, understanding fractional equivalency.

PERFORMANCE OBJECTIVE

The student will be able to measure an object, then rename the measure in other equivalent terms.

ACTIVITY

I. SITUATION

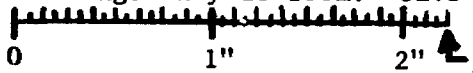
The student is a homeowner who is replacing a broker window. He must first measure the exact length and width of the window taking into consideration the portion of glass that is puttied in. Measurement must be to the closest sixteenth of an inch.

II. STEPS

1) Review activity 7-B-1 on measurement.

2) The students will measure a window in the classroom.

3) Express the length and width of the window in sixteenths and then thirty-seconds. Example:
L = 3' 9/16"; 3' 18/32" W = 2' 8/16"; 2' 16/32"

4) Measure ten things in your room. Give each measure at least two names.
Example: 

2 1/4", 2 2/8", 2 4/16", 2 8/32"

5) Equivalent names for measurements: always take fractions to the simplest or lowest terms. Example: 8/16" = 1/2"
20/32" = 10/16" = 5/8"

a) 12/18" = _____

b) 30/64" = _____

c) 6/12" = _____

RECOMMENDATIONS

The teacher should work into the exercise with the overhead. See examples in steps.

MATERIALS

Room set 6" rule which measures to 1/16 of an inch
References: Exploring Woodworks, page 29; Metalworks, page 37; General Woodworking page 14

MATERIALS

E 7-B 4

SUBJECT Math

CLUSTER Industrial Arts

JOB TITLE Draftsman
Carpenter
Metalworker

CONCEPT

Fractional values placed on graphing paper.

PERFORMANCE OBJECTIVE

The student will be able to describe in picture form the size or dimensions of any given article. This task also requires that the student be able to label these dimensions accordingly.

ACTIVITY Page 1 of 2

I. SITUATION

The student is a carpenter renovating an old table (see activity 7-B-1). Once he knows the dimensions of his table, he then develops a "working drawing". The working drawing is used to later figure up the amount of wood needed for the project. The working drawing usually shows the object in a size smaller than it really is.

II. STEPS

1) The teacher will show with the overhead an example working drawing using 1/4" graph paper and a 6" scale or rule (see attached working drawing).

2) The student will make a working drawing of a sample article (stool, cabinet, desk).

3) The teacher can hand out a given working drawing and ask the dimensions with a given scale.

RECOMMENDATIONS

1) Teacher should have overhead study of a working drawing.
2) Teacher may bring in working drawings used by architects, plumbers, concrete layers to show applications.

MATERIALS

Room set three-foot rules, 1/4" graph paper
References: General Shop, page 63; General Woodworks, page 3; Exploring Woodworks, page 21.

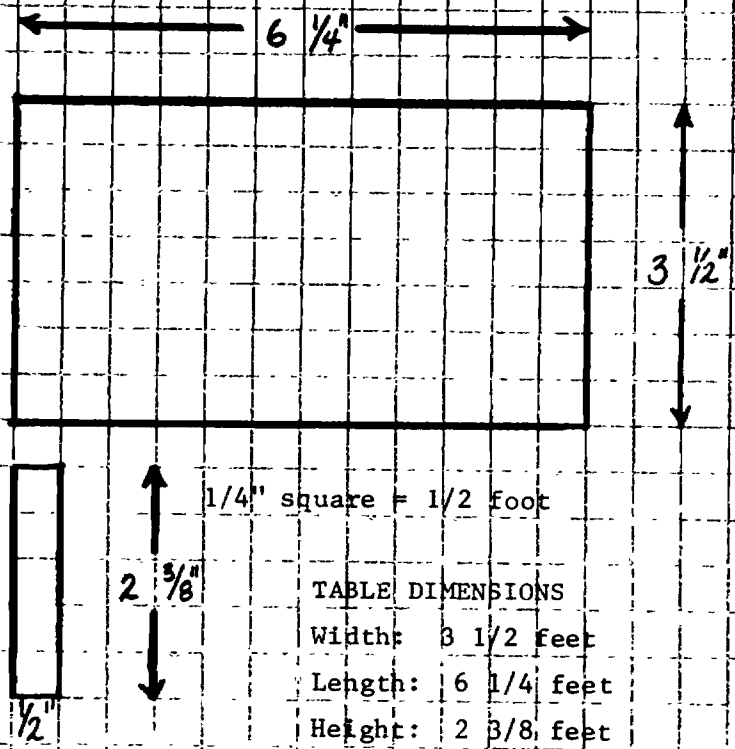
MATERIALS

GRADE 7-B.4

SUBJECT Math

CLUSTER Industrial Arts

JOB TITLE Draftsman
Carpenter
Metalworker



1/4" square = 1/2 foot

TABLE DIMENSIONS

Width: 3 1/2 feet

Length: 6 1/4 feet

Height: 2 3/8 feet

Width of legs: 1/2 foot

E 7-B5

SUBJECT Math

CLUSTER Industrial Arts

JOB TITLE Plastic Fabrications
Sheet Metal Worker

CONCEPT

Developing an understanding square inch.

PERFORMANCE OBJECTIVE

The student will be able, when given a three-dimensional object, to figure the number of square inches involved. He will be able to show the figure in a "stretch-out" or picture drawing.

ACTIVITY

I. SITUATION

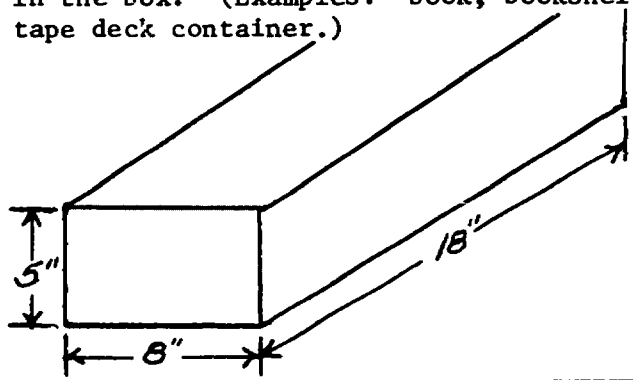
The student is a sheet metal worker who wants to build a fishing gear box. The dimensions of the desired box are 18 inches long, 5 inches deep and 8 inches wide. The question is, "How many square inches of metal is needed?"

II. STEPS

1) Study example problems.

2) Hand out a picture of a metal box or show the class an example metal box. Have the students develop a stretch-out on graph paper and figure the number of square inches.

3) The students can choose the dimensions of a given box and then draw the stretch-out on 1/4" graph paper. Figure the number of square inches of materials in the box. (Examples: book, bookshelves, cabinets, tape deck container.)



RECOMMENDATIONS

The teacher should have a physical example of a sheet metal box.
An overhead example of the above box's stretch-out.

MATERIALS

References: Metalworks, page 39-42; General Shop, page 92

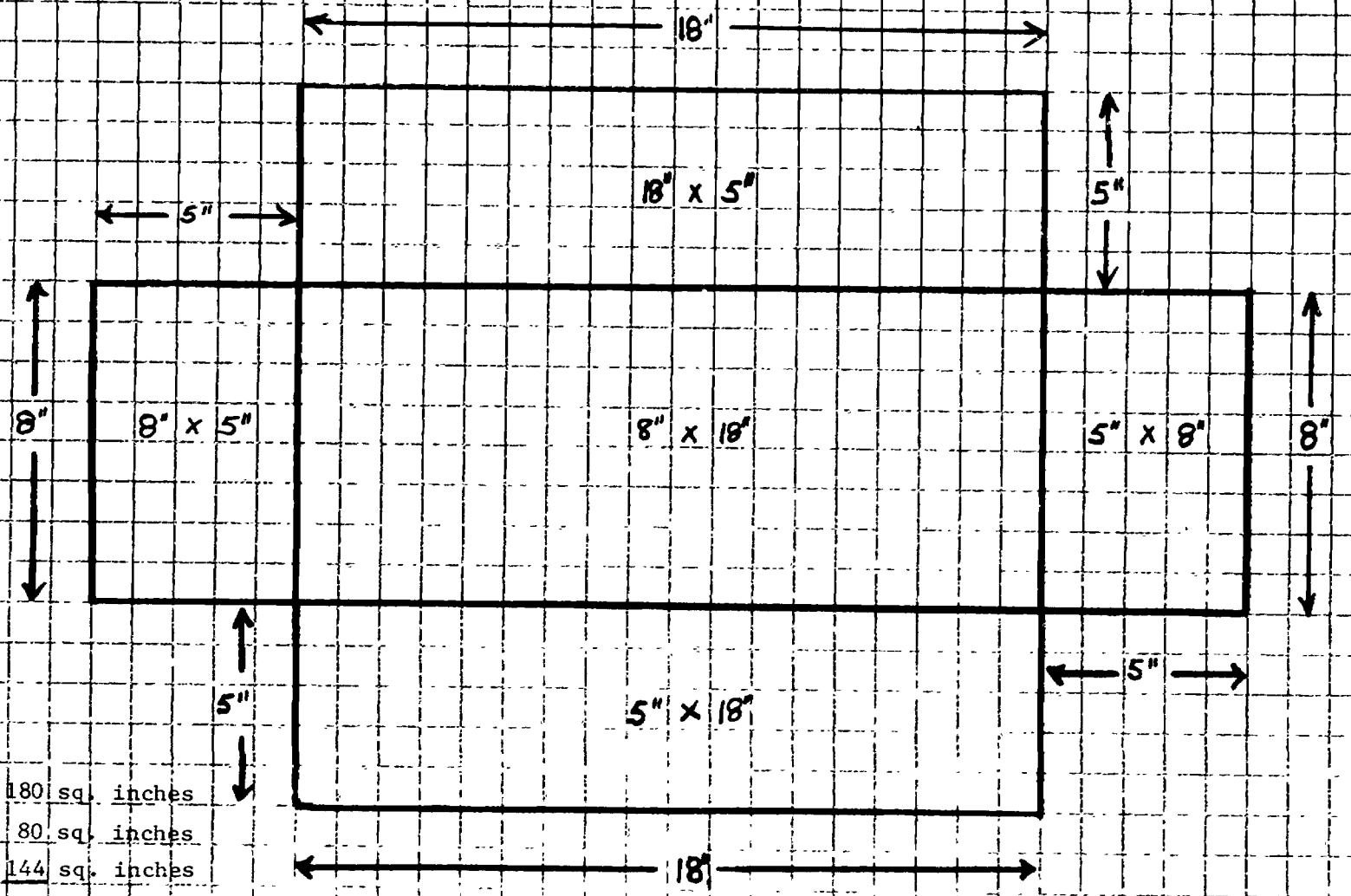
MATERIALS

GRADE 7-B5

SUBJECT Math

CLUSTER Industrial Arts

JOB TITLE Plastic Fabrications
Sheet Metal Worker



FIVE AREAS

2(5" X 18") = 180 sq. inches
2 (8" X 5") = 80 sq. inches
1(8" X 18") = 144 sq. inches
404 sq. inches

7-B 6

SUBJECT Math

CLUSTER Industrial Arts

JOB TITLE Construction Worker

CONCEPT

Geometry: identification of equivalent volumes.

PERFORMANCE OBJECTIVE

The student will learn the definition of a board foot and then learn to apply it to identify equivalent board feet.

RECOMMENDATIONS

Samples of board feet, overhead work-up of board feet.

ACTIVITY

I. SITUATION

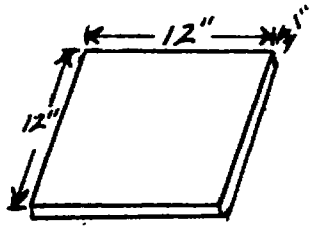
Any worker in construction must be able to identify a board foot. By definition, a board foot is one inch thick, twelve inches wide and twelve inches long. Thus a board foot has always 144 cubic inches.

II. STEPS

1) First, the student must learn to recognize equivalent board feet. By definition, a board foot is a unit of wood measurement one inch thick, twelve inches wide and twelve inches long.

a) A board foot always has 144 cubic inches.
Example: 12" X 12" X 1" = 144 cubic inches

b) An equivalent piece of wood would be a 3" X 4" X 12". 3" X 4" X 12" = 12" X 12" = 144".



2) Name four other pieces of wood equivalent to one board foot.

3) Construct the board foot from exercise #2 using 1/4" graph paper. Let 1/4" square = 1" square.

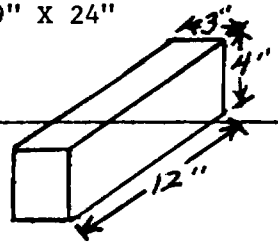
4) How many board feet are in the following pieces of wood? Example: 6" X 8" X 12"

6" X 8" X 12" = 576 cubic inches = 4 board feet

$$144\overline{)576}\quad 4$$

576

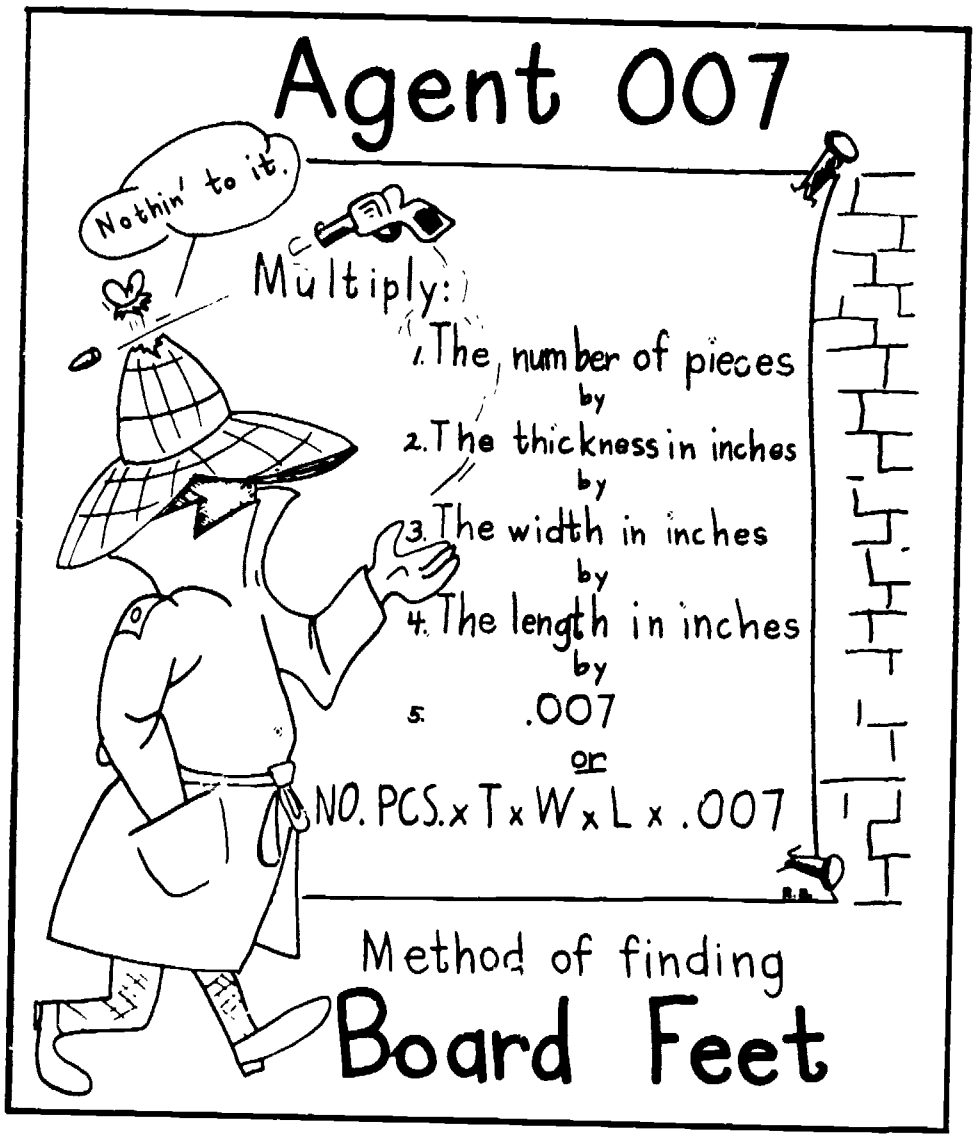
a) 6" X 12" X 12"
b) 9" X 4" X 12"
c) 6" X 9" X 24"



MATERIALS

1/4" graph paper
References: Woodworks, page 21; General Woodworking, page 9

MATERIALS



AGENT .007 METHOD FOR BOARD FEET

By **Richard M. Birch**, Associate Professor — California State College

With secret agents all the rage these days, it was inevitable that one should find his way into the industrial arts classroom. This time "Agent .007" comes to help the junior high school student work out those sometimes tricky board feet problems.

There are several advantages to using the .007 method, including the following:

- ***High interest due to student association with popular TV and movie spy heroes.**
- ***Industrial arts instructor can capitolize on student interest.**
- ***Students need only to work with one mathematical process (multiplication) instead of a variety of processes.**

Any method or process has its disadvantages, but in this case the advantages heavily outweigh the minor disadvantages. Some criticisms may be that:

- ***Answers to board feet problems in some cases will be only close approximations due to the use of the constant .007 instead of the true values of 1/144 or 1/12 x 1/12.**
- ***Eventually the instructor will want to teach a more formal version of finding board feet and, if he is not careful, he may confuse his students.**
- ***This method is practical where small sizes are involved. However, the multiplication can become cumbersome in large size pieces.**

In actual use the student multiplies the number of pieces times the thickness in inches times the width in inches times the length in inches times .007 to find his answer. Simply stated as a formula: No. Pcs. x T" x W" x L" x .007"

The above information was provided through the courtesy of the "WILCRAFTER", Vol. 1, No. 3.

7-C1

SUBJECT Math

CLUSTER Arts and Humanities

JOB TITLE Fine Artist

CONCEPT

Operations with fractions

PERFORMANCE OBJECTIVE

The student will increase his/her skills of using fractions in determining the center of a sheet of construction paper.

ACTIVITY

I. SITUATION

An art student wants to mat two pictures on pieces of construction paper.

II. STEPS

1) First, for practice, the student centers a sheet of notebook paper on a piece of construction paper.

2) Center a painting 11 1/2" X 15" on a piece of construction paper 14 3/4" X 19 1/2".

3) Use a piece of construction paper 18" X 20 1/2" as a border for a 15" X 17" picture. The picture is to be centered except for a 1/2" extra bottom border. Therefore, the sides and top will have the same border width.

RECOMMENDATIONS

MATERIALS

MATERIALS

GRADE 7-C 2

SUBJECT Math

CLUSTER Arts and Humanities

JOB TITLE Fine Artist

CONCEPT

Geometry

PERFORMANCE OBJECTIVE

This activity will increase the student's ability to construct three-dimensional drawings.

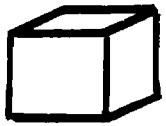
ACTIVITY

I. SITUATION

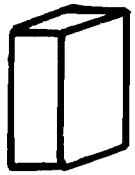
An artist needs to draw four three-dimensional perspective objects for a painting he/she is creating.

II. STEPS

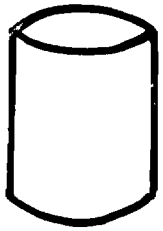
The student will construct a three-dimensional drawing of a cube, a rectangular solid, a cylinder and a building:



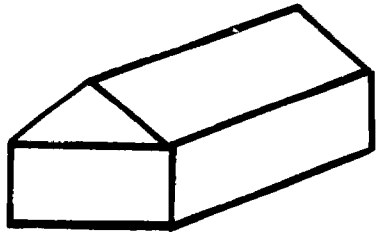
CUBE



RECTANGULAR SOLID



CYLINDER



BUILDING

RECOMMENDATIONS

MATERIALS

MATERIALS

7-C 3

SUBJECT Math

CLUSTER Arts and Humanities

JOB TITLE Macrame Artist

CONCEPT

Proportion, calculation of basic operations

PERFORMANCE OBJECTIVE

The student will determine the amount of jute needed to make a 30 inch by 36 inch wall hanging, as well as the cost of the project.

ACTIVITY

I. SITUATION

A student wants to make a 30 inch wide wall hanging of natural jute. He/she knows that cotton cord costs 2¢ a foot and natural jute (3 ply) costs 2¢ a yard.

II. STEPS

1) Determine how many cords it will take to make the 30 inch wide wall hanging if it takes 6 cords per inch of hanging.

2) The wall hanging will extend down 3 feet. It takes 8 inches of cord to make 1 inch of hanging. Find the length of each cord needed for the hanging.

3) What is the cost of the jute needed for the project?

RECOMMENDATIONS

MATERIALS

MATERIALS

GRADE 7-C 4

SUBJECT Math

CLUSTER Fine Arts

JOB TITLE Artist

CONCEPT

Proportions

PERFORMANCE OBJECTIVE

The student will be able to enlarge a photograph to make a painting.

ACTIVITY

I. SITUATION

The student will enlarge a 3" X 5" photograph to four times its size.

II. STEPS

1) Determine the enlarged dimensions.

2) Gather the materials.

3) Overlay the small graph paper on the photograph and trace the photograph and squares.

4) Use the large graph paper to transpose the picture onto the 12" X 20" paper.

RECOMMENDATIONS

MATERIALS

1 sheet of 1" graph paper, 1 sheet of ¼" graph paper, 1 sheet of 12" X 20" paper, 1 charcoal pencil, 1 3" X 5" photograph, straight edge

MATERIALS

7-C5

SUBJECT Math

CLUSTER Arts and Humanities

JOB TITLE Potter

CONCEPT

Multiplying decimals, using the metric system

PERFORMANCE OBJECTIVE

Upon satisfactory completion of the activity, the student will determine the cost of materials needed to make a pot by utilizing decimals and the metric system.

ACTIVITY

I. SITUATION

The student is a potter and has his own pottery shop. He needs to know the cost of the clay needed to make a pot.

II. STEPS

1) Student takes a large handful of wet clay and determines the weight or mass of the clay.

2) Student computes the cost of the clay, with the information that wet clay costs $.11 per pound or $.24 per kilogram.

3) History: A potter's wheel has been found in Northern Iran dating about 4,000 B.C. How old is this wheel?

4) For a related activity, see eighth and ninth grade potter activity.

RECOMMENDATIONS

MATERIALS

Metric balance, clay

MATERIALS

GRADE 7-D

SUBJECT Math

CLUSTER Business

JOB TITLE Bank Teller

CONCEPT

1) Addition
2) Subtraction

PERFORMANCE OBJECTIVE

The student will demonstrate comprehension of computing using addition and subtraction as measured by the completion of the attached activity with a minimum of 70% accuracy.

ACTIVITY

I. SITUATION

Student "A" is a bank customer who has had difficulty in reconciling his/her checking account.

Student "B" is a bank teller in customer service who has been asked by the manager to assist the "customer".

II. STEPS

1) Instructor will provide students A and B with needed forms and information.

2) Instructor will have filled in check register and bank balance sheets and will have built into the checkbook at least three computation errors. (Example: one deposit addition error, one check subtraction error, one overdraft check charge or overlooked service charge or safe deposit box charge, etc.)

3) Role-players will change and situation will change. Suggest at least three situations from step #2 to involve the whole class.

4) Problems will be worked out through reconciliation.

RECOMMENDATIONS

MATERIALS

Bank balance sheets with instruction for balancing, sample cancelled checks, checkbooks and check records and deposit records

MATERIALS

E 7-F

SUBJECT Math

CLUSTER Hospitality

JOB TITLE Waiter

CONCEPT

Adding wages and tips, sum of decimals

PERFORMANCE OBJECTIVE

Upon the satisfactory completion of the decimal unit, the student will use the sum of decimals in determining tips and wages earned by Bill to a 95% degree of accuracy.

87

RECOMMENDATIONS

ACTIVITY

I. SITUATION

There are blue-collar jobs as well as white-collar jobs in the hospitality and recreation area. Colleges give courses in hotel management while high school graduates might find jobs as bellmen, waitresses, lifeguards, etc. We choose the occupation of a waiter for this activity.

II. STEPS

Bill is a waiter and receives a wage of $2.76 per hour. Determine Bill's gross income for the week of April 8 through April 15.

Check total = total hours X $2.76 + tips.

	Hours		At $2.76/hour		Tips
Monday Apr 10	8	X	$2.76 = ____	+	$ 7.25 = ____
Tuesday Apr 11	7	X	$2.76 = ____	+	$ 5.76 = ____
Wednesday Apr 12	8	X	$2.76 = ____	+	$ 2.77 = ____
Thursday Apr 13	5	X	$2.76 = ____	+	$ .94 = ____
Friday Apr 14	9	X	$2.76 = ____	+	$10.74 = ____
Saturday Apr 15	10	X	$2.76 = ____	+	$25.72 = ____

MATERIALS

MATERIALS

GRADE 7-H

SUBJECT Math

CLUSTER Personal Services

JOB TITLE Teacher

CONCEPT

Percentages

PERFORMANCE OBJECTIVE

The student will determine the percentage for grades on a test using proportion.

ACTIVITY

I. SITUATION

A teacher gives a 15-problem test and would like to know the percentage for:

a) 15 problems correct
b) 14 problems correct
c) 13 problems correct
d) 12 problems correct
e) 11 problems correct
f) 10 problems correct

II. STEPS

Example: b) $\frac{14}{15} = \frac{x}{100}$

$\frac{1400}{15} = x$

$$15\overline{)1400.0} \quad 93.3$$
$$135$$
$$50$$
$$45$$
$$5.0$$

$93.3 = x$

93.3% for 14 problems correct

7A

49

RECOMMENDATIONS

MATERIALS

MATERIALS

E 7 - 1 /

SUBJECT Math

CLUSTER Manufacturing

JOB TITLE Physicist
Electronics Engineer

CONCEPT

Scientific notation, exponents

PERFORMANCE OBJECTIVE

The student will be able to multiply and divide numbers in scientific notation

50

RECOMMENDATIONS

ACTIVITY

I. SITUATION

You are a physicist in a university laboratory and you are working on an experiment that has to do with the nature of matter. You know that electrons are electrically charged particles which are part of every atom and you consider them to be small spheres, like BB's, that spin around atoms. They are very small; you say they have a radius of 2.8×10^{-13} cm.

To prove a point to your students, you want them to find out how many of these BB's you could line up together, touching each other, in a 1 centimeter row. You realize of course, that this is an impossible task since electrons repel each other and would fly apart immediately. If each electron has a mass of 9.1×10^{-28} grams, how much mass does this row of electrons have?

Find 1 cm on your ruler and then think about why matter, made up of electrons and heavier particles is no heavier than it is.

N = number of electrons in 1 cm row. If radius = 2.8×10^{-13}, then diameter = 5.6×10^{-13}.

$$N = \frac{1}{5.6 \times 10^{-13}} = \frac{10^{13}}{5.6} = 1.79 \times 10^{12} = 1{,}790{,}000{,}000{,}000 = 1 \text{ trillion, } 790 \text{ billion.}$$

M = mass of electrons = $1.70 \times 10^{12} \times 9.1 \times 10^{-28} = 1.63 \times 10^{-15}$ grams.

MATERIALS

GRADE 7-12

SUBJECT Math

CLUSTER Manufacturing

JOB TITLE Machine Operator

CONCEPT

Addition of decimals

PERFORMANCE OBJECTIVE

1) Students will add a series of decimals in a horizontal format.

2) Upon the satisfactory completion of the decimal activity, the student will measure and record the shaft by using the decimal system to a degree of 98% accuracy.

51

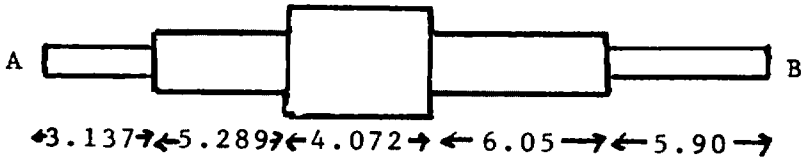
ACTIVITY

I. SITUATION

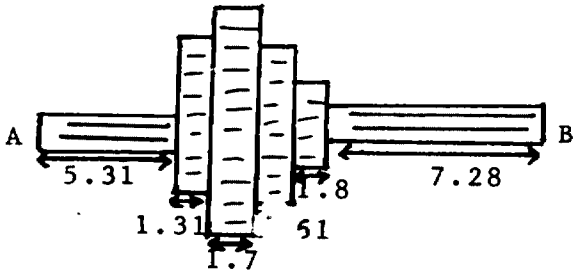
A tool and machine operator needs to find the length of two shafts from A to B.

II. STEPS

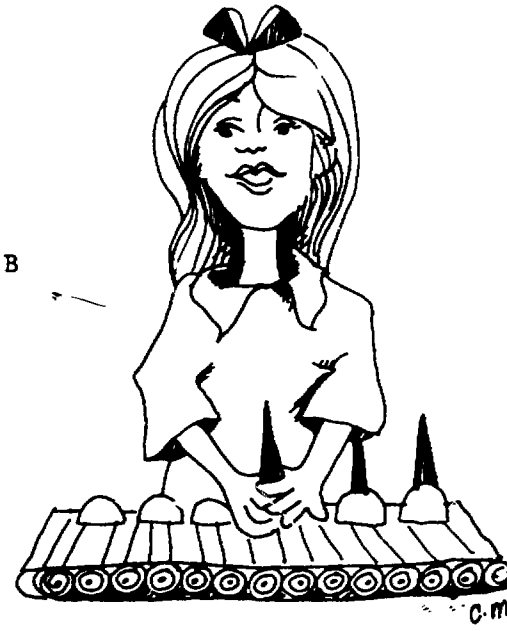
Add the decimal readings of the shaft parts.



SHAFT #1



SHAFT #2



RECOMMENDATIONS

MATERIALS

MATERIALS

E 7 - I3

SUBJECT Math

CLUSTER Manufacturing

JOB TITLE Chemical Shop Worker,
Manufacturing Shop
Supervisor

CONCEPT

Ratios, concentration of solutions, mixtures

PERFORMANCE OBJECTIVE

The student will be able to calculate the ratio of the volume of one substance to the total volume of a mixture, knowing the volume of each added to the mixture

52

ACTIVITY

I. SITUATION

You are the chemist in charge of a large industrial laboratory where liquid fuel for space rocket engines is produced. You must make sure that the fuel is mixed in the proper proportions or else the rockets will not operate correctly, endangering the lives of the astronauts aboard the space ship. The two fuels you mix together are called fuel x and fuel y. You know that you must have 15% x and 85% y in the final fuel. You have three problems:

1. You must mix a batch of 7000 gal. of fuel for one space probe. How much of each fuel will you need?

2. At the Florida Space Port there is 42,500 gal. of y on hand and they want you to send them the right amount of x so they can launch the Mars space shuttle. How much x will you send?

3. There is a batch of fuel, 35,000 gal. on hand in Seattle that is 60% y and 40% x How can you add x or y to it to make it in the right proportion? Which one will you add and how much?

RECOMMENDATIONS

MATERIALS

GRADE 7-J

SUBJECT Math

CLUSTER Transportation

JOB TITLE Airline Pilot

CONCEPT

Aeronautical chart measurements

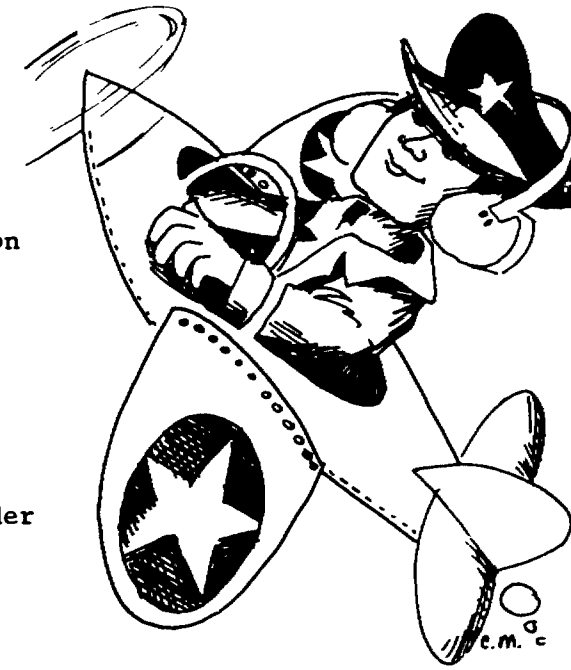
PERFORMANCE OBJECTIVE

The student will be able to make distance and direction (heading) measurements on aeronautical charts, with accuracy within five miles or five degrees at least 80% of the time as measured by the instructor.

ACTIVITY

I. SITUATION

You are an airline pilot whose route of flight takes you from Boise to Mountain Home Air Force Base, to Pocatello, to McCall and back to Boise. You will draw your route of flight on the chart provided. You will measure the distance between airports on your route and determine the direction of flight on each leg of the journey.



II. STEPS

1) Draw line from airport to airport.

2) Using the compass, mark off 10 nautical mile increments along each leg and measure the remainder accurately. Distance will be determined by the scale on the chart legend.

3) Measure the direction to fly from airport to airport. Set up protractor to measure the angle at which the flight path crosses a meridian (north-south line).

4) Fill out flight log. Suggested form:

Leg	Heading	Distance	Ground Speed	Time
Boise - Mountain Home				
Mountain Home - Pocatello				
Pocatello - McCall				
McCall - Boise				

RECOMMENDATIONS

MATERIALS

Aeronautical charts of the Boise area, one per student; rulers; compasses; protractors

MATERIALS

GRADE 7-K /

SUBJECT Math

CLUSTER Health Occupations

JOB TITLE Medical Doctor

CONCEPT

Reading charts, ratios

PERFORMANCE OBJECTIVE

The student will be able to read a simple temperature conversion chart and calculate ratios.

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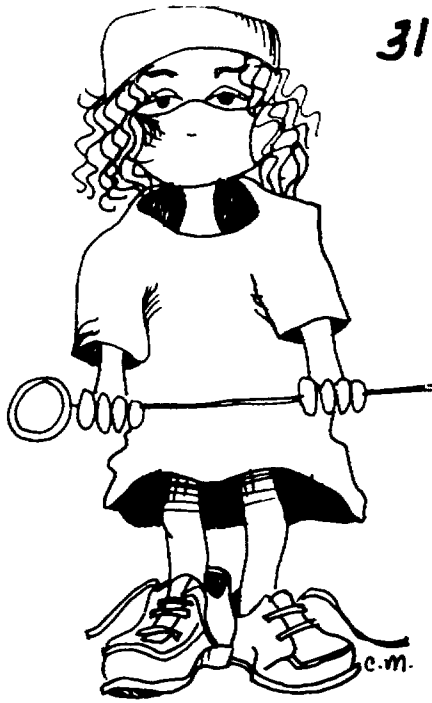
RECOMMENDATIONS

ACTIVITY

I. SITUATION

You are a doctor in Boise. You have several children who are running a fever from overwork at school; and you have discovered a wonderful drug that will make them well if you give exactly the right dose, but won't help at all if you give them too much or too little. Your drug works if you give the child exactly 9 milligrams for each pound of his body weight for each degree centigrade his temperature is above normal. Normal temperature is 98.6°F (37°C). And, by the way, your nurse dropped and broke your brand new centigrade thermometer this morning; and all she could find to use was your old-fashioned Fahrenheit model.



II. STEPS

Here is a list of your patients, their weights and their temperatures. The first dose is worked out for you so you can get the idea.

Name	Weight	Temp.(°F)	Temp.(°C)	Degree Above Normal	Dose
Janie	80	99.5	37.5	.5	360 mg
Susie	85	98.6			
Tom	160	102.2			
Sam	115	100.4			
Einstein	170	104			
Janet	77	101.3			

Janie weighs 80 pounds, and her temperature is .5°C above normal. Her recommended dose of medicine is then .5 X 80 X 9 = 360 mg.

Temperature Conversion	
°F	°C
98.6	37
99.5	37.5
100.4	38
101.3	38.5
102.2	39
103.1	39.5
104	40

MATERIALS

GRADE 7-K 2

SUBJECT Math

CLUSTER Health

JOB TITLE Operating Room Supervisor

CONCEPT

Reading chart

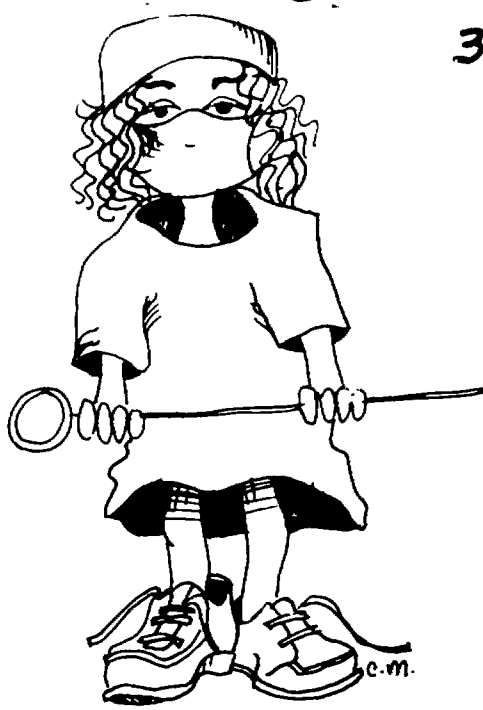
PERFORMANCE OBJECTIVE

The student will be able to read a chart and determine how long the operating room equipment must stay in the sterilizer to be safe for use.

ACTIVITY Page 1 of 2

I. SITUATION

In your job as operating room supervisor, you must insure that the equipment used by the doctors and nurses during operations is sterile. The device you use to heat the equipment to kill germs is called a sterilizer. The sterilizer is a kind of pressure cooker. It not only heats but increases the pressure on the instruments. The time required for sterilizing equipment depends on how hot the sterilizer gets. You have helpers working for you who actually do the sterilizing, but you must prepare the chart showing how long to sterilize each bundle of instruments.



II. STEPS

1) Fill out chart #1 to give your helpers their orders.

2) Use the chart #2 to make your decisions. (Chart #1 and #2 on the next page.)

RECOMMENDATIONS

MATERIALS

MATERIALS

SUBJECT Math

CLUSTER Health

JOB TITLE Operating Room Supervisor

STERILIZER WORKSHEET

Bundle	Time	Temperature
Instruments in padded tray		
Dressings in paper		
Rubber gloves		
Sutures		
Brushes		
Rubber tubing		
Syringes		

CHART #1

MINIMUM STERILIZATION EXPOSURE PERIODS FOR MANUALLY OPERATED CYCLE

	250-254 F (121-123 C) Minutes	270 F (132 C) Minutes
Brushes, in dispensers, in cans or individually wrapped	30	15
Dressings, wrapped in paper or muslin	30	15
Dressings, in canisters (on sides)	30	15
Glassware, empty, inverted	15	3
Instruments, metal only, any number (unwrapped)	15	3
Instruments, metal, combined with suture, tubing or other porous materials (unwrapped)	20	10
Instruments, metal only, in covered and or padded tray	20	10
Instruments, metal, combined with other materials (in covered and/or padded tray)	30	15
Instruments, wrapped in double-thickness muslin	30	15
Linen, packs, (maximal size 12 x 12 x 20"; maximal weight 12 pounds)	30	
Needles, individually packaged in glass tubes or paper (lumen moist)	30	15
Needles, unwrapped (lumen moist)	15	3
Rubber gloves, wrapped in muslin or paper	20	
Rubber catheters, drains, tubing, etc. (lumen moist), unwrapped	20	10
Rubber catheters, drains, tubing, etc., individually packaged in muslin or paper (lumen moist)	30	15
Treatment trays, wrapped in muslin or paper	30	
Utensils, unwrapped	15	3
Utensils, wrapped in muslin or paper	20	10
Syringes, unassembled, individually packaged in muslin or paper	30	15
Syringes, unassembled, unwrapped	15	3
Sutures, silk, cotton or nylon, wrapped in paper or muslin	30	15

CHART #2

GRADE 7-M

SUBJECT Math

CLUSTER Agri-Business
Natural Resources

JOB TITLE Forester

CONCEPT

Proportions

PERFORMANCE OBJECTIVE

The student will determine, by using proportions, the number of surviving trees from a given number of planted ones.

ACTIVITY

I. SITUATION

The Forest Service is planting trees and, due to the specific soil and climate conditions of the area, expects five of every eight trees which are planted to survive.

II. STEPS

The forester determines that the hillside (planting area) can support 850 trees. How many trees will the forester plant to get 850 surviving trees?

RECOMMENDATIONS

MATERIALS

MATERIALS

CODE 7-N

SUBJECT Math

CLUSTER Marine Science

JOB TITLE Ship's Navigator

CONCEPT

Chart reading, interpolation

PERFORMANCE OBJECTIVE

The student will be able to explain the reason why a lighthouse disappears over the horizon and will be able to determine how far away it will be visible.

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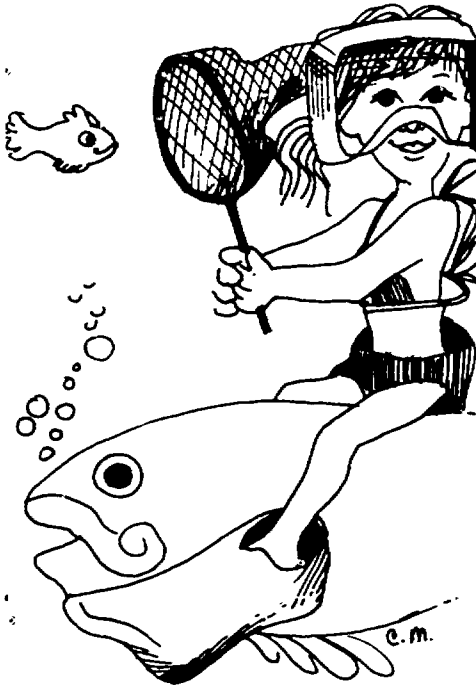
ACTIVITY Page 1 of 2

I. SITUATION

You are the navigator of an ocean liner. You are approaching a point of land where there is a 100' lighthouse. The captain asks you when he should be able to see it. Because of the curvature of the earth, the lighthouse is not visible to you until you get within 11.5 miles if you are looking from very close to the surface of the water. If you climb to the bridge of your ship, however, you can see much further, much in the same way you would climb a tree to see further down the block from your house. The higher up on your ship you stand, the farther away you should be able to see the lighthouse.

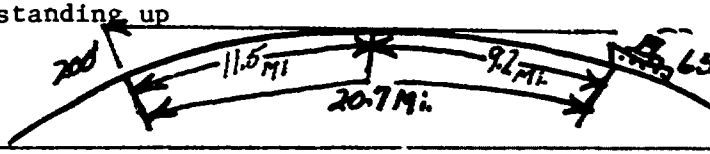


II. STEPS

1) The chart gives the distance to the horizon for various heights. You figure that 65 feet above the water level you can see 9.2 miles to the horizon. That makes a total of 20.7 miles out from the lighthouse when the tip of it should first begin to show above the horizon. Now the passengers below on the main deck want to know when they will first get to see the lighthouse from the main deck, which is 30 feet above the waterline. They also want to know when they will first get to see the torch in the hand of the Statue of Liberty, which is about 305 feet above sea level. You can now tell them both answers.

2) The statue's head is about 40 feet below the torch. When would it be visible to the passengers? How close would you have to be if you were standing up in a small boat?

(chart is on next page)



RECOMMENDATIONS

MATERIALS

Reference: Dutton's Navigation and Piloting, United States Naval Institute, Annapolis, Maryland.

MATERIALS

GRADE 7-N

SUBJECT Math

CLUSTER Marine Science

JOB TITLE Ship's Navigator

ACTIVITY

HORIZON DISTANCES

Height in Feet	Distance in Miles	Height in Feet	Distance in Miles
5	2.5	115	12.3
10	3.6	120	12.6
15	4.4	125	12.9
20	5.1	130	13.1
25	5.7	135	13.3
30	6.3	140	13.6
35	6.8	145	13.8
40	7.2	150	14.1
45	7.7	155	14.3
50	8.1	160	14.5
55	8.5	165	14.7
60	8.9	170	14.9
65	9.2	175	15.2
70	9.6	180	15.4
75	9.9	185	15.6
80	10.3	190	15.8
85	10.6	195	16.0
90	10.9	200	16.2
95	11.2	260	18.5
100	11.5	270	18.9
105	11.7	300	19.9
110	12.0	310	20.1

CODE 7-0-1

SUBJECT Math

CLUSTER Marketing

JOB TITLE Retail Grocery Clerk

ACTIVITY

I. SITUATION

Student is a checker in a local grocery store. Customer comes to checkstand with a basket of groceries containing fifteen items, ten of which are split-priced.

CONCEPT

Division to next highest whole number, multiple addition of figures, cash register operation.

PERFORMANCE OBJECTIVE

The student will demonstrate knowledge of division to next highest whole number by checking a fifteen-item basket of groceries through a mock-up checkstand with 80% accuracy in determining the split price of each multiple-priced item as measured by a performance test.

II. STEPS

1) Present an introduction to retail grocery careers. Give a background description of each of the following:
   a) Manager
   b) Assistant Manager
   c) Department Head
   d) Checker

2) Present an introduction to the capitalist system and profit motive.
   a) Lecture students regarding profit being the businessman's reward for the risk taken; therefore, the business is entitled to the next highest cent on a split-priced item.

3) Check single-priced items first.
   a) Ring on keys
   b) Call prices

4) Group multiple items by price and labels.
   a) Determine amount purchased versus sale price.
   b) Divide mentally to the next highest whole number to determine quantity price
      Example: If the price for Hunts Tomatoes is 3/89¢ and the customer has one can, $\frac{29.66}{3/89¢}$ = 30¢ as the price to the customer for one can.

RECOMMENDATIONS

MATERIALS

1 NCR cash register (schedule two weeks ahead of time from Career Education Dept.), split-pricing test, background handout regarding retail grocery careers

MATERIALS

GRADE 7-0-2

SUBJECT Math

CLUSTER Marketing

JOB TITLE Retail Clerk

CONCEPT

Addition, subtraction

PERFORMANCE OBJECTIVE

The student will demonstrate knowledge of addition and subtraction in a role-playing situation where he makes change utilizing the "subtract-coming add-going" concept, as measured by a score of 90% on a written test and 85% on a performance test.

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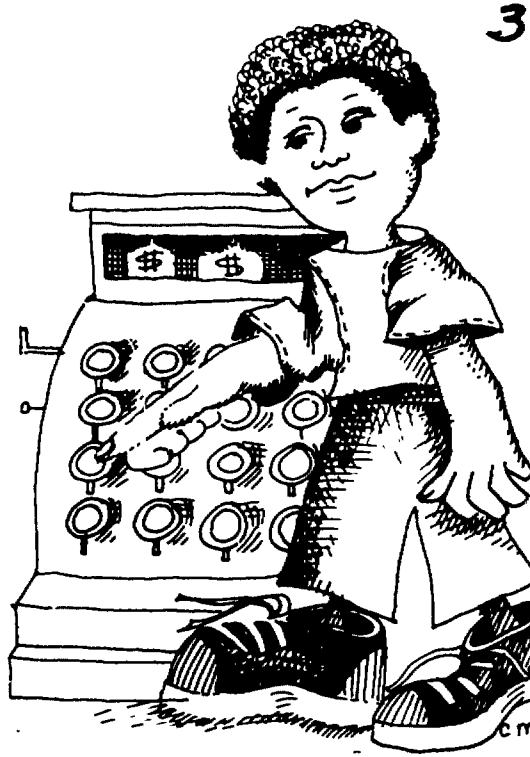
ACTIVITY

I. SITUATION

Student is a checker in a local grocery store. Customer comes to checkstand with a basket of gorceries containing fifteen items, ten of which are split-priced.



II. STEPS

1) Present an introduction to retail grocery careers. Give a background description of each of the following:
   a) Manager
   b) Assistant Manager
   c) Department Head
   d) Checker

2) Present an introduction to the capitalist system and profit motive.
   a) Lecture students regarding profit being the businessman's reward for the risk taken; therefore, the business is entitled to the next highest cent on a split-priced item.

3) Upon completion of cash register operation of checking and totalling tax chart:
   a) student will be tendered money to surpass amount owed,
   b) student will make change using least amount of money items (bills, coins) to arrive at proper change for customer.

4) Whole class will be tested with attached chart.

RECOMMENDATIONS

MATERIALS

1 NCR cash register, play money, change-making test, sales tax charts

MATERIALS

RETAIL GROCERY Name_____
Date_____

MAKING CHANGE - - - - - - - -REGULAR METHOD

USE AS FEW COINS AS POSSIBLE

	01¢	05¢	10¢	25¢	50¢	$1.00	$5.00	
17¢ out of 50¢								
$2.73 out of $5.00								
$1.29 out of $5.00								
81¢ out of $1.00								
39¢ out of $10.00								
21¢ out of 50¢								
$7.57 out of $10.00								
$3.02 out of $5.00								
$2.76 out of $10.00								
$1.57 out of $5.00								
51¢ out of 75¢								
$2.01 out of $2.50								
$7.53 out of $10.00								
$2.57 out of $3.02								
$3.99 out of $5.04								
$3.49 out of $10.00								

GRADE 7-P

SUBJECT Math

CLUSTER Construction

JOB TITLE Planner, Designer
Architect

CONCEPT

Area, Volume, Scale Drawing

PERFORMANCE OBJECTIVE

The student will be able to compute the area to the nearest square foot, the volume to the nearest cubic foot, make a scale drawing of a planned patio and estimate the cost of concrete needed.

ACTIVITY

I. SITUATION

You are an architect. You are planning to build a concrete patio for a customer. He wants the patio to be 10' wide and 15' long. You think the concrete should be 6" thick. You need to present your customer a scale drawing (1"=1') and with an estimate of the area of the patio, the volume of concrete needed to complete the patio and the cost of concrete at $ .85/cu. ft.

II STEPS

1) Prepare the scale drawing - at ½"=1', 15' converts to 7½"; 10' converts to 5" - A half inch grid can be drawn over the entire surface, if desired, so the students can count the number of square feet.

2) Compute the area, A=LxW = 150 sq ft. Does this agree with the count?

3) Discuss the concept of volume. Each square on the scale drawing represents ½ cu. ft. Compute the volume V = LxWxH = 10x15x½ = 75 cubic feet. See if this agrees with the count of squares.

4) Now determine the cost of the concrete. At $.85 per cubic foot, the material will cost $63.75. That is the cost of concrete only and does not take into consideration the cost of excavation, forms or labor.

RECOMMENDATIONS

MATERIALS

MATERIALS

DE 8-A-1

SUBJECT Math

CLUSTER Home Economics

JOB TITLE Home Economics Teacher
Homemaker

CONCEPT

Decimals - multiplication, division and addition

PERFORMANCE OBJECTIVE

The student when ask to make an item will study the recipe and estimate the cost.

ACTIVITY Page 1 of 2

I. SITUATION

Whether a home economics teacher or a homemaker, one of the first decisions one must make is to decide on a recipe and then judge if it will cost more to make it from scratch than already prepared. The hardest part of the decision comes when one calculates his/her own time involved in making an item.

II. STEPS

1) Study the newspapers for current prices of milk, flour, eggs, shortening, sugar. List the current prices.

Example: Milk, ½ gal. = $ .76
Flour, 5 lbs. = $1.10
Sugar, 5 lbs. = $1.25
Eggs, 1 doz. = $ .60
Shortening, 5 lbs. = $1.15

2) What would be the price of the following quantities of the above ingredients?

Note: 1 C = 8 ounces
2 C = 16 ounces = 1 lb
2 C = 1 pint
2 pints = 1 quart
4 quarts = 1 gallon

(a) 1 C milk = _____

(b) 1½ C sugar = _____

RECOMMENDATIONS

Go step by step in figuring the cost of, say, 1 C sugar.

MATERIALS

Room set of newspapers
Cookbooks---Reference: The World of Foods, Medoed, pg 509

MATERIALS

GRADE 8-A-1

SUBJECT Math

CLUSTER Home Economics

JOB TITLE Home Economics Teacher
Homemaker

(c) 3 C flour = _____

(d) 3/4 C shortening = _____

(e) 2 eggs = _____

3) The following is a recipe for chocolate pudding:

(a) Estimate the cost of preparing it.

(b) If, when fixed, this serves six people, what would be the cost per serving?

(c) If it cost $ .35 to buy a can of instant pudding, does it cost more or less to make it? How much? (The can serves one person.)

(d) A pudding mix, which serves six, cost $ .27, but you must add three cups of milk. How much does this totally cost? How much does it cost per person? Does it cost more or less to make it from scratch? How much?

Chocolate Pudding

4 C milk

2 sq chocolate (Note: 6 sq cost $ .48)

¼ c cornstarch

1 C sugar

1/8 tsp salt

2 tsp vanilla

2 tsp shortening

(Just approximate cost of salt, cornstarch and vanilla.)

E 8-A-2

SUBJECT Math

CLUSTER Home Economics

JOB TITLE Consumer
Purchasing Agent

CONCEPT

Percentages

PERFORMANCE OBJECTIVE

The student, when given a total for merchandise bought, will then compute the sales tax needed for the amount purchased.

ACTIVITY

I. SITUATION

A purchasing agent just bought $15.36 worth of merchandise. In the state of Idaho, there is a 3% sales tax. He/she must compute the amount of sales tax.

Example: 3% of $15.36

$$\begin{array}{r} 15.36 \\ \times\ .03 \\ \hline .4608 \end{array}$$ -----(3% = 3/100 = .03)

Sales tax = $.46

II. STEPS

1) Understanding the meaning of percents.

Example: 4% means 4 cents out of every 100
4/100 or .04

Write the percents as decimals:

(a)	5%	(d)	75%
(b)	3%	(e)	105%
(c)	20%	(f)	12½%

2) Figuring the amount of sales tax for merchandise purchased.

Example: $27.57 worth of groceries
Sales tax is 3%. How much sales tax does one pay? What will be the total bill?

$$\begin{array}{r} 27.57 \\ \times\ .03 \\ \hline .8271 \end{array}$$

sales tax = $.83 (rounded off)

RECOMMENDATIONS

MATERIALS

MATERIALS

GRADE 8-A-2

SUBJECT Math

CLUSTER Home Economics

JOB TITLE Consumer
Purchasing Agent

ACTIVITY Page 2 of 2

Total Paid = $27.57
.83
$28.40

Figure the sales tax and total bill for the following totals.

(a) $5.06

(b) $12.98

(c) $1.45

(d) $33.57

(e) $125.61

E 8-A-3

SUBJECT Math

CLUSTER Home Economics

JOB TITLE Homemaker
Purchasing Agent
Home Economist

CONCEPT

Decimals, division, multiplication and addition.

PERFORMANCE OBJECTIVE

The student, when given a grocery list, will compute the total cost of the items purchased.

ACTIVITY

I. SITUATION

The student is a homemaker who has just purchased her weekly supply of groceries. To compute the price of various items, it is necessary to study the group buying activity and also to understand the logic behind rounding off prices.

II. STEPS

1) Compute the individual cost of the grocery list below and then the total cost of the list.

5 lbs of oranges - - - - - 8 lbs/$1.00

3.7 lbs ground beef - - - - -$ .85/lb

8 lbs carrots - - - - - $ .12/lb

4 cans of soup - - - - - 5 cans/$1.00

10 lbs sugar - - - - - $1.56/5lbs

15 cans pop - - - - - 7 can/$1.00

1 gallon of milk - - - - - $ .76/half gallon

2) Compute the individual cost per type of item and then the total bill.

3 shirts - - - - - $3.89 a shirt

4 dresses - - - - - 2/$23.00

2 pants - - - - - $7.99 a pair

4 pairs of socks - - - - - 3 pair/$1.00

5 yards of material - - - - - 2 yds/$4.25

3) Figure a 3% sales tax for problems (1) and (2). (See Activity 8-A-2)

RECOMMENDATIONS

Do a class demonstration of unit buying.
Show example grocery sales slips or salesman's slips.

MATERIALS

Roomset of newspapers with adds

MATERIALS

GRADE 8-A-4

SUBJECT Math

CLUSTER Home Economics

JOB TITLE Professional Seamstress

CONCEPT

Fractions, multiplication, decimals, addition.

PERFORMANCE OBJECTIVE

The student will be able to compute the cost of making an item, figuring in time, and then compare that price to a similar manufactured item.

ACTIVITY

I. SITUATION

The student is a professional seamstress who is making a dress for a client. Besides figuring the cost for material, thread, zipper, and facing, it is necessary to figure the worth of one's time and charge for that.

II. STEPS

1) Study the pattern requirements below and figure the cost.

2 3/4 yds polyester material - -	$2.98/yd
1 spool thread - - - - - - - - - -	$ .39/spool
1 zipper - - - - - - - - - - - - -	$ .79
5 yds facing - - - - - - - - - - -	$ .45/3 yds

2) If the seamstress takes 3½ hours to sew the dress and she charges $2.50 per hour, how much does she make?

3) How much does the client pay for the dress?

4) Have the student bring in various clothes patterns. Give approximate prices for the various items needed. Figure the cost of the apparel.

5) Study the local paper and compare the price of a similar apparel if it was bought from a store. Does one save any money?

RECOMMENDATIONS

Sample patterns

MATERIALS

Room set newspapers

MATERIALS

ADE 8-A-5

SUBJECT Math

CLUSTER Home Economics

JOB TITLE Novelty Seamstress

CONCEPT

Fractions: addition
subtraction
multiplication

PERFORMANCE OBJECTIVE

1) The student, when given the dimensions of a finished quilt and the size of each individual block, will compute the amount of material needed.

2) Given the size of a finished quilt, the student will figure the number of yards of material needed for the backing.

RECOMMENDATIONS

Bring in example quilt blocks and finished quilts.

ACTIVITY

I. SITUATION

A novelty seamstress makes quilts, often irregular in size, to meet the desires of the buyer. The buyer may also request the size of the individual block, the color scheme and the backing to go with the quilt. After the individual blocks are cut out and embroidered, they are sewn together on all sides. The seams consume 1/2 inch of each block or a total of one inch. To understand the loss of material in the seams, one must accurately determine the total yardage needed for the project.

II. STEPS

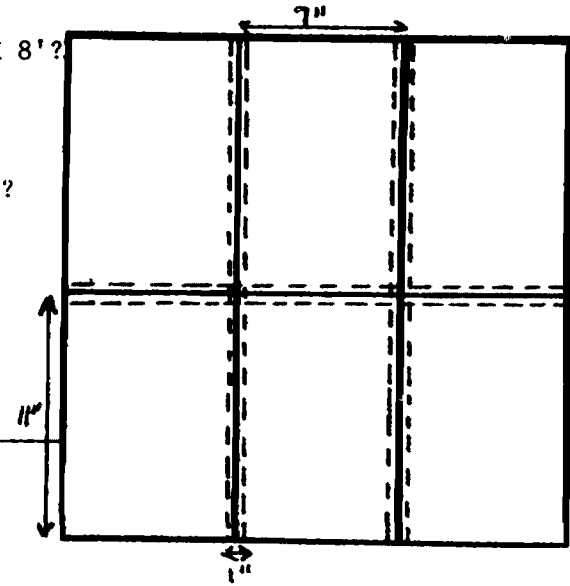
1) Determining the finished dimensions of a quilt block whose original size is 8" X 12"; the seam is set at 1/2 inch. See the example to the right.

a) What would be the finished dimensions of a 6" X 10" block with a 1/2" seam?

b) What would be the finished dimensions of a 6" X 10" block with 5/8" seams?

2) How many blocks with finished dimensions 6" X 8" would be needed for a quilt that is 6' X 8'?

3) A backing of flannel is needed for the quilt in step #2. How many yards of flannel will be needed if the flannel is 45" wide? How many yards would be needed if the flannel is 36" wide?



Note: 1/2" seam is 1"
Together 1/2" + 1/2" = 1"
Finished block is 7" X 8"

MATERIALS

MATERIALS

GRADE 8-B-1

SUBJECT Math

CLUSTER Industrial Arts

JOB TITLE Carpentry

CONCEPT

Measurement to the nearest thirty-second of an inch. Fraction equivalency.

PERFORMANCE OBJECTIVE

The student will be able to measure any object to the nearest thirty-second of an inch. Once the measurement is taken, he should be able to rename the fraction in equivalent terms.

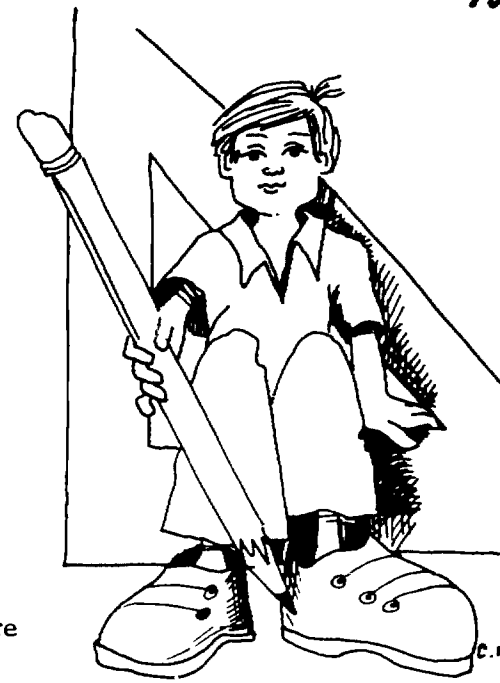
RECOMMENDATIONS

Show work-up on overhead concerning equivalent points on a scale.

ACTIVITY

I. SITUATION

The student is a glass repairman, who is measuring the size of a broken pane. First, measuring the dimensions to the closest thirty-second of an inch, he then renames the dimension in simplified terms.



II. STEPS

1) Study measurement unit 7-B-1.

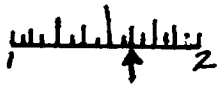
2) Each tudent will have a three foot rule or longer tape.

3) The measurement of a given window in the room will be taken. Compare the students measurements for test of accuracy.

4) Have the students find the measure of the outside of their book and then the inside. Is there a difference in the two measurements? How much? Measure the inside and outside measurements of the chalkboard.

5) Once a measurement is known, say to the nearest thirty-second, one should rename the dimensions in lowest terms.

Example: $\frac{10"}{16} = \frac{5"}{8}$ $\qquad 5' \frac{20"}{32} = 5' \frac{10"}{16} = 5' \frac{5"}{8}$



$\frac{20"}{32}$

$\frac{10"}{16}$

$\frac{5"}{8}$

(a) $\frac{12"}{16}$

(b) $\frac{30"}{32}$

(c) $7' \frac{8"}{32}$

MATERIALS

Reference: Metal Works, pg. 198.

MATERIALS

GRADE 8-B 2

SUBJECT Math

CLUSTER Industrial Arts

JOB TITLE Electronics Technician

CONCEPT

Discover the relation between voltage and current in a simple circuit.

PERFORMANCE OBJECTIVE

The student will be able to find and use a linear relation between voltage and current in a simple circuit.

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ACTIVITY Page 1 of 2

4

I. SITUATION

You are an electronics technician working for the Space Agency. Your boss sends you a box full of resistors marked with their resistance values; three batteries, one 6-volt, one 3-volt, one 1½-volt; and a volt-ammeter. He tells you that he needs to know if there is any connection between the voltage on the resistors and the current through them. Your next pay raise depends on your finding the answer.

II. STEPS--Recommended Approach

1) Measure and record in table form the current through each resistor at each voltage (sample log on next page).

2) Graph the results on Cartesian coordinates and look for patterns. Suggest voltage (E) and current (I) for the coordinates and identify points on graph with color code or some other way to connect the point with its resistor.

3) The graph should show a direct relation between E and I. (E=IR)

4) After discovery of function in step #3, the value of unknown resistance can be calculated from a single set of voltage and current readings.

RECOMMENDATIONS

MATERIALS

Batteries: 6-volt, 3-volt, 1½-volt (any voltage will do); selection of pre-measured resistors; volt-ammeter; graph paper

MATERIALS

GRADE 8-B 2

SUBJECT Math

CLUSTER Industrial Arts

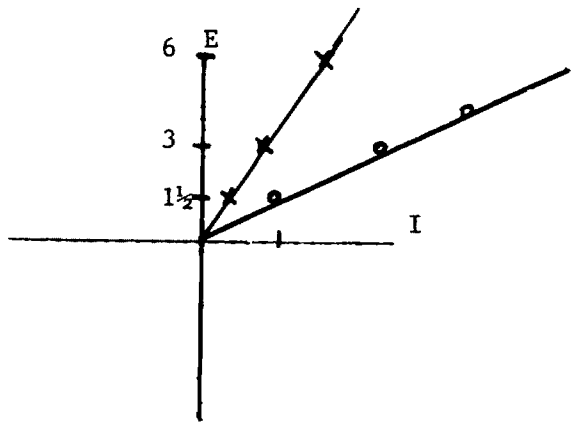
JOB TITLE Electronics Technician

ACTIVITY

II. STEPS

R (Resistance)	E (Voltage)	I (Current)
R_1 = _____ ohms	6	
R_1	3	
R_1	1½	
R_2 = _____ ohms	6	
R_2	3	
R_2	1½	
etc.		

Plot of E vs I



GRADE 8-B-3

SUBJECT Math

CLUSTER Industrial Arts

JOB TITLE Carpentry
Architect
Homebuilder

CONCEPT

Multiplication and division of decimals in a given formula

PERFORMANCE OBJECTIVE

The students will demonstrate the ability to determine the amount of wood necessary for constructing or repairing a given wood project. The amount will be determined by substituting dimensions into a board foot formula.

RECOMMENDATIONS

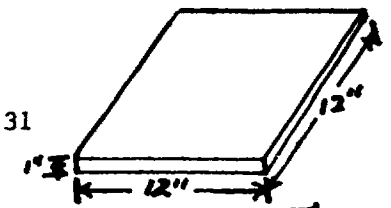
Work the situation problem on the overhead. Bring actual cost list from lumber companies for wood.

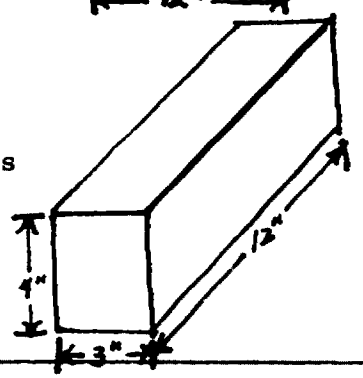
ACTIVITY Page 1 of 2

I. SITUATION

The student is a carpenter who is rebuilding an end table. Using the measurements below, he will figure first the board feet needed and then the cost of the project. The formula for board feet is:
Board feet = N x L x W x T x .007
where N = number of boards
L = length of boards in inches
W = width of boards in inches
T = thickness of boards in inches
Dimensions of end table: N = 5
L = 42"
W = 6"
T = 2½" (2.5")
Bf = 5 x 42" x 6" x 2.5" x .007 = 22.19 cubic inches
If the cost of the wood is $.78 per board foot, how much would it cost for this project?

$$\begin{array}{r} 22.19 \\ \times\ .78 \\ \hline 17752 \\ 15533 \\ \hline 17.3082 \end{array}$$ or $17.31





II. STEPS

1) Learning to recognize equivalent board feet:
By definition, a board foot is a unit of wood measurement one inch thick, twelve inches wide and twelve inches long.
a) A board foot always has 144 cubic inches.
Example: 1" x 12" x 12" = 144 cubic inches
b) An equivalent piece of wood would be 3" x 4" x 12". So 3" x 4" x 12" = 144 cubic inches.
c) Name four other pieces of wood equivalent to one board foot.

(continued)

MATERIALS

Reference: General Shop, page 117, General Woodworks, page 8.

MATERIALS

GRADE 8-B-3

SUBJECT Math

CLUSTER Industrial Arts

JOB TITLE Carpentry
Architect'
Homebuilder

II. STEPS

2) The formula for finding the total number of board feet for a project is: Board feet = N x L x W x T x .007. Example: Find the board feet for three pieces of 2" x 10" x 36" board. Bf = 3 x 36" x 2" x 10" x .007
= 21.60 x .007
= 15.12 cubic inches

Find the number of board feet for the following:

a) 1" x 12" x 30", 5 pieces
b) 6" x 24" x 48", 3 pieces

3) Figure the cost of the wood above if:

a) Part 2a is poplar wood which costs $.76 per board foot.
b) Part 2b is fir plywood and costs $.59 per board foot.

DE 8-B-4

SUBJECT Math

CLUSTER Industrial Arts

JOB TITLE Sheet Metal Worker
Architect

ACTIVITY Page 1 of 2

53

I. SITUATION

A builder is reading the construction prints from the architect. The given scale is 1:4 or ¼. He/she immediately knows that a wall measuring seven feet on the print would be 28 feet (4x7) in real life. If the scale was 1:25, the length of the wall would be 7x2.5 or 17.5 feet.

CONCEPT

Ratio and proportions

PERFORMANCE OBJECTIVE

Given a scale drawing, the student will be able to enlarge it to two, two and a half, and three times its actual size. Given the original size of an object, the student will be able to draw it to a reduced scale.

II. STEPS

1) A sheet metal box measures 3' x 2' x 1'. Write the following, in terms of inches.
   a) Double the dimensions.
   b) Divide the original dimensions in half.
   c) Triple the original dimensions.
   d) Divide the original dimensions in thirds.

2) Give the actual measurements of the attached house layout. The drawing is a 1:4 or ¼ scale. Give measures in terms of feet.

3) Draw a 1:4 or ¼ scale drawing of your home. Use ¼" graph paper with ¼" representing one foot.

RECOMMENDATIONS

Work together a carpenter's print.

MATERIALS

¼" graph paper, room set 6" rule
Reference: General Woodworks, page 6

MATERIALS

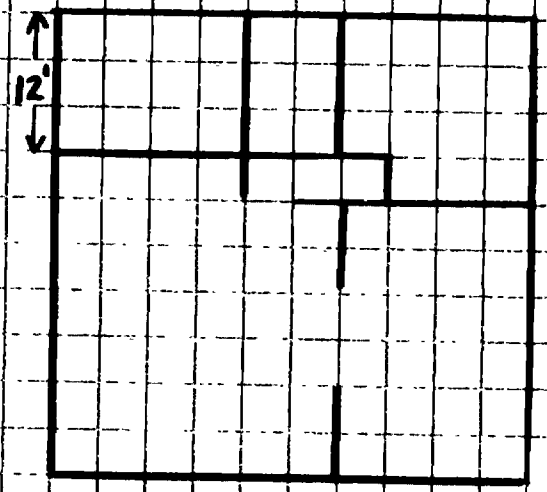
GRADE 8-B-4

SUBJECT Math

CLUSTER Industrial Arts

JOB TITLE Sheet Metal Worker

Architect



1/4" = 1', so 1' = 4'

CODE 8 - B5

SUBJECT Math

CLUSTER Industrial Arts

JOB TITLE Carpentry, Metal Work

CONCEPT

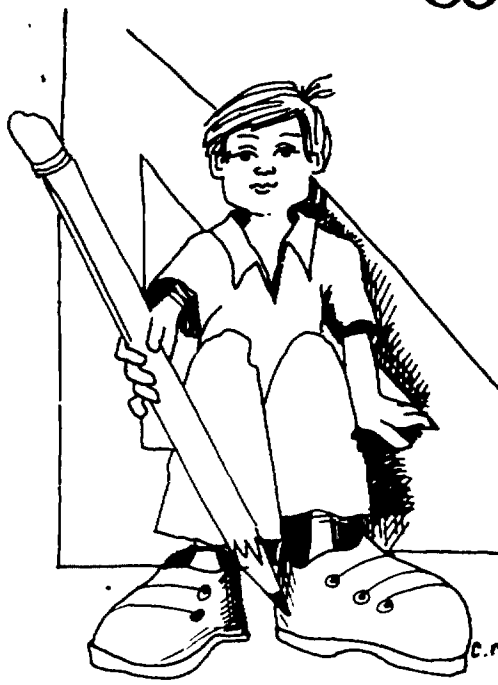
Division of Fractions

PERFORMANCE OBJECTIVE

The student when given the total length of a board or metal will be able to divide it into equal portions. The portions will not always be whole number parts.

ACTIVITY

I. SITUATION



A carpenter wants to cut a board into four equal parts to build some shelves. If the total length of the board is 18 ft., one must figure the length of each fourth.

Example: P = ¼ of length
P = 18' divided by 4
P = 18/1 x ¼

P = 18/4 = 9/2 or 4½ '

Note: Carpenters have a trick to the trade of physically figuring out this measurement.

STEPS:

1. The students will study an example of dividing a given length in half, and thirds without use of math.
2. Next, the students will duplicate a length on paper. Showing the diagonal used, they will mark off lengths that are first half the total length and then marks to show thirds of the total length.
3. The students will now measure the exact total length of the line and then use mathematics to find the fractional measures.
4. Observe any differences between the physical and the mathematical measures.
5. Divide the following lengths first in half and then in thirds:
   a. 2 5/8' b. 5 3/4 ' c. 4 5/32 '

RECOMMENDATIONS

An overhead work-up is needed on the carpenter's physical method for dividing a given length.

Overhead work-up of division.

MATEIRALS Ref: General Woodworks, p.18
GeneralShop p. 78

Room set 6" rules

MATERIALS

GRADE 8-B[6]

SUBJECT Math

CLUSTER Industrial Arts

JOB TITLE Carpenter
Various Occupations

CONCEPT

Metric system, conversion

PERFORMANCE OBJECTIVE

The student will be able to convert our system of measurement to the metric system.

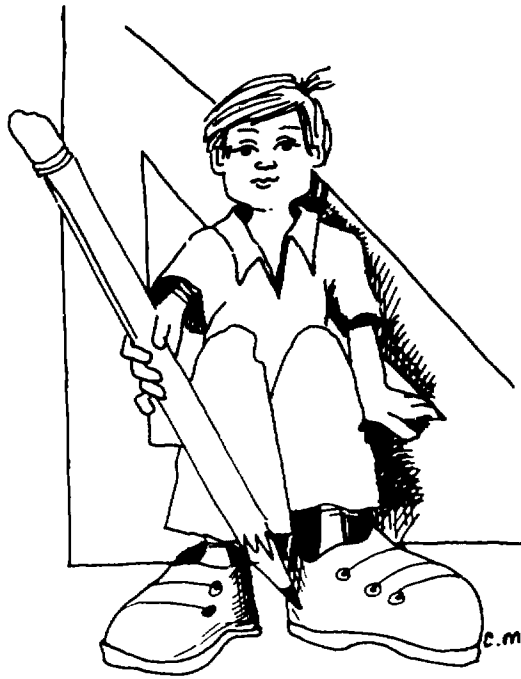
RECOMMENDATIONS

Before students start this activity, they must understand the metric system, its prefixes and how the decimal moves.

ACTIVITY

I. SITUATION

To keep up with the changing times, carpenters, etc. must learn to understand the metric system and how it compares with our system. After working with the metric system, one will find that it is much easier to use. It adapts well to division and multiplication.



II. STEPS

1) Learning the metric conversions:
   1" = 2.5 centimeters
   100 centimeters = 1 meter
   1 meter = 39.37 inches
   a) 10" = _____ cm
   b) 5 yards = _____inches = _____cm
   c) 5½ yards = _____ cm
   d) 17.78 meters = _____ cm = _____ inches
   e) 144" = _____ yards

2) What would be the metric measurement for the following:
   a) 2' x 4'
   b) 1½" x 3½"
   c) 4" x 8"
   d) 8" x 3'

3) What type of problems would arise for a carpenter using the metric system? What problems would be eliminated?

4) When dividing a piece of wood in sections, would the parts be easier or harder to figure out?
   a) 3 meters divided into 2?
   b) 16 centimeters divided into 4 parts?

MATERIALS

Reference: eighth and ninth grade Individualized Math Program, unit XVI, page 454-455 (Attached)

MATERIALS

Unit XVI - Level (3)

A. The metric system is the measurement system used in most countries of the world, except the United States. The basic standard units of metric measure are:

Meter - the standard unit of length
Gram - the standard unit of weight
Liter - the standard unit of volume

In the metric system, the prefix of a unit of measure indicates the relationship to a basic unit of measure.

The metric system is based on powers of ten.

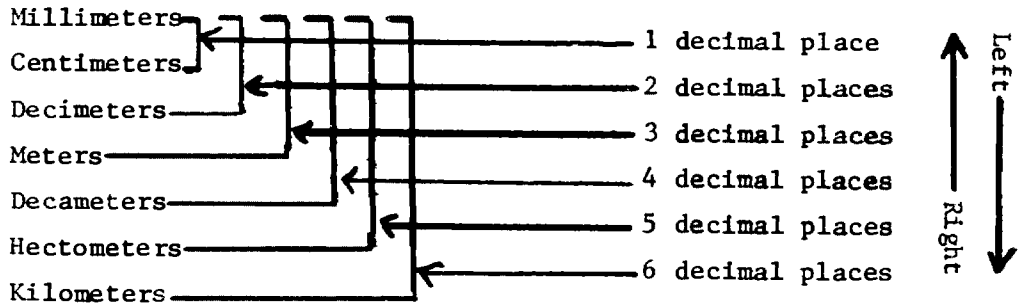
If the basic unit was meters the following relationships exist:

1 millimeter = 1/1000 meter of 1000 millimeters = 1 meter
1 centimeter = 1/100 meter or 100 centimeters = 1 meter
1 decimeter = 1/10 meter or 10 decimeters = 1 meter
1 decameter = 10 meters or 1/10 decameter = 1 meter
1 hectometer = 100 meters or 1/100 hectometer = 1 meter
1 kilometer = 1000 meters or 1/1000 kilometer = 1 meter

Another way of writing the same relationships is with decimals:

1 meter = 1000 millimeters
100 centimeters
10 decimeters
1 meter
.1 decameters
.01 hectometers
.001 kilometers

Hence: Conversion from one metric unit to another is accomplished by moving the decimal point.



GRADE 8-B6

SUBJECT Math

CLUSTER Industrial Arts

JOB TITLE Carpenter
Various Occupations

Examples:

(1)

3.46 grams =
- 3460 milligrams
- 346 centigrams
- 34.6 decigrams
- 3.46 grams
- .346 decagrams
- .0346 hectograms
- .00346 kilograms

(2) Convert 3000 milligrams to decigrams.

Think: milli to deci, I go down on the metric chart; therefore, I move the decimal to the left. How many units do I go down? 2

Therefore: 30.00. mm = 30 decimeters

2 places left

(3) 4.2 decagrams to ____ centigrams.

Think: Deca to centi means going up the chart; therefore, I move the decimal to the right. How many units up? 3

Therefore: 4.200 decagrams = 4200 centigrams

Reference: Exploring Modern Mathematics, Book I; page 305, problem 8-23.

Practice Problems:

Complete the sentences.

(1) 42.7 grams = _____ decagrams.

(2) .4653 kiloliters = _____liters.

(3) 346 centigrams = _____decigrams.

(4) 16435 milliliters = _____decaliters.

(5) .34 hectograms = _____decigrams.

(6) 347 decaliters = _____ milliliters.

(7) 17.58 centimeters = _____ hectometers.

(8) 23.1 grams = _____ kilograms

(9) 34.789 milliliters = _____ deciliters.

(10) 80976 centigrams = _____ hectograms.

GRADE 8-B 6

SUBJECT Math

CLUSTER Industrial Arts

JOB TITLE Carpenter
Various Occupations

B. Addition and subtraction involving metric measures with differing prefixes: change all measures to the same prefix first.

Example:

(1) 100 decimeters + 3 meters = _____ decameters.

1 decameter + .3 decameters = (1.3) decameters.

(2) 432 hectograms - 3.6 decagrams = _____ decigrams.

.432 decigrams - .036 decigrams = (.386) decigrams.

(3) (12 grams) (11.3 centigrams) = _____ hectograms.

(.12 hectograms) (.00113 hectograms) = (.000156) hectograms.

Practice Problems:

(1) Complete each sentence.

(a) .145 kilometers + 14 decimeters = _____ meters.
(b) 3.5 decagrams + 2 grams = _____ grams.
(c) 36 hectoliters - 3 decaliters = _____ liters.
(d) 4365 centimeters - 5 decimeters = _____ meters.
(e) (3.5 decagrams) (.1 decigrams) = _____ grams.
(f) (5 kilometers) (3.8 meters) = _____ decameters.
(g) 17 hectoliters - 50 liters = _____ centiliters.
(h) .34 milligrams - 170 centigrams = _____ grams.

(2) Write a mathematical sentence and solve.

(a) Tom has a rope that is 92.56 meters long. If he divides the rope into four equal parts, how long is each part?
(b) What is the total length, in meters, of three parts of the rope in the above problem?

(3) Joe swims 500 meters. If the width of the pool is 250 decimeters, how many laps did he swim?

(4) The Olympic record for weight lifting was 143.01 kilograms. This was broken when someone lifted 1520.90 hectograms. How many more grams did the second person lift?

GRADE 8-C/

SUBJECT Math

CLUSTER Arts and Humanities

JOB TITLE Macrame Artist

ACTIVITY

I. SITUATION

The student is to make a 40 inch wide wall hanging of cotton cord. Cotton cord costs 2¢ a foot.

6

CONCEPT

1) Proportions
2) Basic operation
3) Percentage

PERFORMANCE OBJECTIVE

The student will determine the amount of cotton cord needed to make a 40 inch by 48 inch wall hanging, as well as the cost of the project plus the sales tax.

II. STEPS

1) Determine how many cords it will take to make a 40 inch wide hanging if it takes 8 cords per inch of hanging.

2) The wall hanging will extend down 4 feet. It takes 10 inches of cord to make 1 inch of hanging. Find the length of each cord needed for the hanging.

3) Determine the cost of the cotton cord for the project.

4) Determine the total cost with a 3% sales tax.

RECOMMENDATIONS

MATERIALS

MATERIALS

DE 8-C 2

SUBJECT Math

CLUSTER Arts and Humanities

JOB TITLE Fine Artist

CONCEPT

Measurements with a ruler

PERFORMANCE OBJECTIVE

Given the materials, the student will mat a picture on construction paper.

RECOMMENDATIONS

ACTIVITY

I. SITUATION

1) The student has a 12" X 16" picture to be matted under a piece of 14" X 18" construction paper. The student is to cut a hole in the construction paper which will provide a 1 1/2" border on the sides and top and a 1 3/4" border on the bottom.

2) The student has a 14" X 18" picture to be matted under a sheet of construction paper. The picture is to overlap the hole in the construction paper by 1/4" on each side. The border is 1 1/2" on the side and top and 2" on the bottom.

II. STEPS

1) Determine the size of the construction paper to be used.

2) Determine the size of hole to be cut.

6

MATERIALS

MATERIALS

GRADE 8-C 3

SUBJECT Math

CLUSTER Arts and Humanities

JOB TITLE Fine Artist

ACTIVITY

I. SITUATION

You want to construct a circle with a diameter of 10 inches, and you only have a piece of paper, a ruler and a pencil for materials.

62

CONCEPT

Construction of a large circle

PERFORMANCE OBJECTIVE

Student will be able to construct a circle using a ruler, pencil and paper.

II. STEPS

1) Construct a square with sides of 10 inches.

2) Find the center by constructing the diagonals of the square.

3) From the center, use the ruler and pencil to measure 5-inch dash marks around. These dash marks will make a circle.

RECOMMENDATIONS

MATERIALS

Paper, pencil, ruler

MATERIALS

GRADE 8-C 4

SUBJECT Math

CLUSTER Art and Humanities

JOB TITLE Advertising Designer

CONCEPT

Proportion

PERFORMANCE OBJECTIVE

The student will be able to determine th size of a billboard and its objects from a layout.

ACTIVITY

I. SITUATION

An advertising designer is asked to take a 6" X 9" layout and make a billboard.

II. STEPS

1) If the billboard is to be 8 feet high, determine the length of the board.

2) A circle on the layout has a 4-inch diameter. Determine the diameter on the billboard.

3) A large K has a height of 5 inches on the layout, determine its height on the billboard.

RECOMMENDATIONS

MATERIALS

MATERIALS

GRADE 8-C

SUBJECT Math

CLUSTER Arts and Humanities

JOB TITLE Potter

CONCEPT

Determining percentage

PERFORMANCE OBJECTIVE

Upon satisfactory completion of the activity, the student will accurately calculate the amount of wet clay shrinkage involved in a pottery project by the use of percentage.

ACTIVITY

I. SITUATION

When a potter throws a pot, the clay is very wet; and he can expect a 5% shrinkage in weight as it dries in the air. He can expect a 7% shrinkage in weight during the firings. The student is to determine the amount of shrinkage in weight from his clay.

II. STEPS

A student weighs out a handful of clay to be 3.8 kg.

1) Determine the amount of weight loss when it dries in the air.

2) Determine the amount of weight loss during the firings.

3) Determine the total weight loss during both operations.

RECOMMENDATIONS

MATERIALS

MATERIALS

ADE 8-D

SUBJECT Math

CLUSTER Business

JOB TITLE Auctioneer
Rancher
Saleyard Manager

CONCEPT

Percentages

PERFORMANCE OBJECTIVE

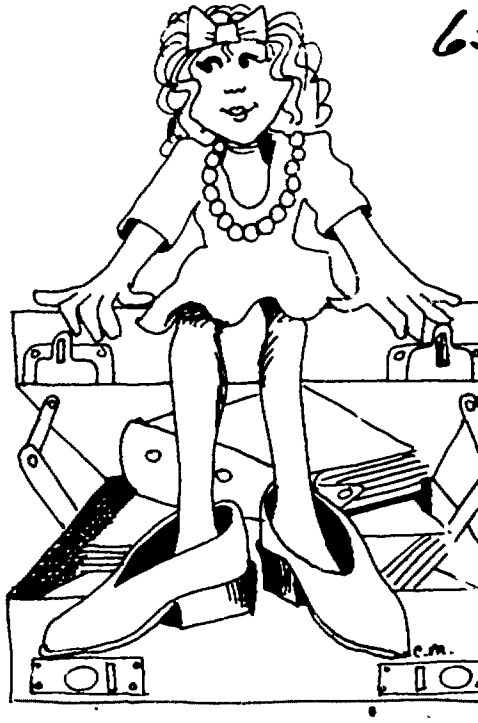
The student will demonstrate comprehension of percentage computation as measured by the completion of the attached activity with a minimum of 70% accuracy.

ACTIVITY

I. SITUATION

Student "A" is a rancher who raises hereford cattle.
Student "B" is a livestock saleyard manager.
Student "C" is a professional auctioneer.

The rancher has brought "X" head of calves to the saleyard to consign for immediate sale. The going average price of calves is $110 per head. The saleyard manager agrees to sell the cattle for 5% of the sale price. The auctioneer works for the saleyard for 10% of the manager's income.



II. STEPS

1) Given a hypothetical number of beef and the above situation information, the role-playing students will compute:
   a) Total dollars involved in the sale
   b) Dollars to rancher
   c) Dollars to saleyard manager
   d) Dollars to auctioneer

2) For a whole class activity, each student could role-play a buyer who is allotted a given amount of money to spend. The auctioneer could offer calves one at a time for sale to the group, using pictures of animals.

3) For a secondary activity, students could note beef prices on a daily basis from local newspapers over a week's time to invest money in beef on Monday and sell during the week. Groups could work in competition to see who could create the greatest profit in the shortest time.

RECOMMENDATIONS

MATERIALS

MATERIALS

GRADE 8-F

SUBJECT Math

CLUSTER Recreation

JOB TITLE City Recreation Director

CONCEPT

Problem-solving

PERFORMANCE OBJECTIVE

1) Given a program and limits, the students must:
   a) Determine the cost of the program.
   b) Determine the number of participants.
   c) Determine the cost per participant.

2) Upon the satisfactory completion of the recreation activity, the students will be able to schedule "x" number of basketball games for "x" number of teams on 6 basketball courts over a period of 16 weeks by using the problem-solving method.

RECOMMENDATIONS

ACTIVITY

I. SITUATION

A city recreation director wants to develop a men's basketball program. His research shows that six school courts are available five nights a week at no cost. Three games can be played each night and each team has ten players. A team only plays once a week. The program starts in November and ends in February, lasting for sixteen weeks.

II. STEPS

1) Determine how many teams can participate.

2) Determine how many players can participate. Program costs:

   A referee costs $5.00/game
   A gym supervisor costs $5.00/game
   A scorer costs $2.50/game
   Trophies cost $275

3) Determine the cost of the program.

4) Determine the cost per player.

MATERIALS

MATERIALS

GRADE 8-H

SUBJECT Math

CLUSTER Personal Services

JOB TITLE Barber

CONCEPT

Decimals and percentages

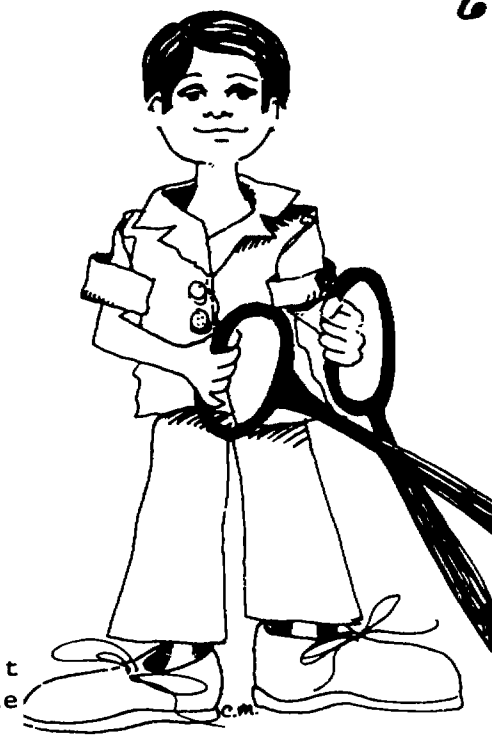
PERFORMANCE OBJECTIVE

Upon satisfactory completion of the activity, the student will be able to accurately compute the daily take-home pay of an apprentice barber by the use of the method outlined.

ACTIVITY

I. SITUATION

Bill owns his own two-chair barber shop. He has an apprentice working with him. The apprentice receives 72% of the amount he collects from haircuts, shaves, etc. On Tuesday he cut 23 heads at $2.75 each, gave 5 shaves for $1.25 each and one shampoo for $2.25.



II. STEPS

1) Determine the apprentice's gross income for Tuesday.

2) Determine the amount he receives (72% of step #1).

3) Because of taxes, social security and retirement; a person's take-home pay is about 60% of his earnings. Determine the take-home pay of the apprentice (60% of step #2).

III. ANSWERS

1) $71.75

2) $51.67

3) $31.00

RECOMMENDATIONS

MATERIALS

MATERIALS

GRADE 8-H 2

SUBJECT Math

CLUSTER Personal Service

JOB TITLE Cosmetologist

CONCEPT

Percentage

PERFORMANCE OBJECTIVE

The student will accurately determine the percentage a cosmetologist earns in a week.

ACTIVITY

I. SITUATION

Many beauty operators are paid a percentage of what they earn. Jane receives 72% of what she earns.

II. STEPS

1) Determine Jane's daily salary:
   a) Monday she earns $55.40
   b) Tuesday she earns $52.40
   c) Wednesday she earns $64.75
   d) Thursday she earns $57.00
   e) Friday she earns $68.25

2) Check by adding the earnings and taking 72%.

RECOMMENDATIONS

MATERIALS

MATERIALS

CODE 8 - I

SUBJECT Math

CLUSTER Manufacturing

JOB TITLE Chemist

CONCEPT

Ratios, solutions, mixtures

PERFORMANCE OBJECTIVE

The student will be able to determine the concentration, or proportion of contents, in a mixture.

RECOMMENDATIONS

ACTIVITY

I. SITUATION

You are the supervisor of a chemical manufacturing plant. You have 1000 liter container that is fed by two pipes. Pipe No. 1 comes from a tank that contains a solution that is 25% water and 75% chemical z. Pipe number 2 comes from a tank that is 75% water and 25% chemical z. You have learned through trial and error and over the years that you can obtain any concentration you need, from 25% z to 75% z simply by figuring out how much liquid to draw from each storage tank.

How much of each do you need to make 1000 liters with the following concentrations:

1. 25% z
2. 30% z
3. 50% z
4. 60% z
5. 70% z
6. 75% z

(You should be able to do three parts of this in your head.)

MATERIALS

GRADE 8 - 12

SUBJECT Math

CLUSTER Manufacturing

JOB TITLE Physicist
Electrical Engineer

CONCEPT

Scientific Notation, Exponents

PERFORMANCE OBJECTIVE

The student will be able to multiply and divide numbers using scientific notation.

RECOMMENDATIONS

ACTIVITY

I. SITUATION

(See 7th Grade exercise, same subject)

Continue the BB analogy one step further. Suppose you could make a square pattern 1 cm on a side. How many electrons would you need and what would be their mass?

Let N be number of electrons in a 1cm row.

$N = 1.79 \times 10^{12}$

then N^2 = number needed to fill the square.

$N^2 = 3.20 \times 10^{24}$

M_2 = mass of square of electrons

$M_2 = 3.20 \times 10^{24} \times 9.1 \times 10^{-28} =$

2.91×10^{-3} grams = .0000064 lb.

What would be the mass of a 1cm cube of electrons?

N^3 = number required = 5.74×10^{36}

M_3 = mass of cube

$M_3 = 5.74 \times 10^{36} \times 9.1 \times 10^{-28} = 5.22 \times 10^{9}$ g = 1.148×10^{7} lb = 5,740 tons

It is important to note that it is not possible to pack electrons together in a 1cm cube like this. This problem is simply an exercise in using scientific notation for computations and can be used to stress the density of electrons and therefore the vast spaces supposed to be empty within the atom.

MATERIALS

DE 8-J

SUBJECT Math

CLUSTER Transportation

JOB TITLE Airline Pilot

CONCEPT

Chart measurements and speed/time computations

PERFORMANCE OBJECTIVE

The student will be able to measure distances and direction on an aeronautical chart within 3 miles and 3 degrees and compute times within 3 minutes 80% of the time as determined by the teacher.

RECOMMENDATIONS

ACTIVITY

I. SITUATION

You are an airline pilot whose route of flight takes you from Boise to Mountain Home Air Force Base to Pocatello to McCall and back to Boise. You will draw your route of flight on the chart provided. You will measure the distance between airports on your route and determine the direction of flight on each leg of the journey. Your aircraft flies at 360 nautical miles per hour. In addition to distance and direction, you must calculate the time in minutes required on each leg, rounded off to the nearest minute.

II. STEPS

1) Draw a course line from airport to airport.

2) Using the compass, mark off any convenient length increments (10 miles is recommended as determined from scale on legend). Measure left-over distance.

3) Measure direction of flight path.

4) Fill out log. Suggested form:

Leg	Heading	Distance	Ground Speed	Time
Boise - Mountain Home				
Mountain Home - Pocatello				
Pocatello - McCall				
McCall - Boise				

5) Compute time required on each leg of the flight. Convert time to minutes.

$$\text{Time in hours} = \frac{\text{Distance}}{\text{Speed}} = \frac{\text{Distance}}{360\text{mph}} \qquad \text{Time in minutes} = \text{Time in hours} \times 60 = \frac{\text{Distance}}{360} \times \frac{60}{1}$$

MATERIALS

1 aeronautical chart, 1 protractor, 1 ruler, 1 compass per student

MATERIALS

GRADE 8-K

SUBJECT Math

CLUSTER Health

JOB TITLE Medical Doctor

CONCEPT

Ratios, functions

PERFORMANCE OBJECTIVE

The student will be able to convert weights from pounds to kilograms and solve simple ratio problems.

ACTIVITY

I. SITUATION

You are the doctor on duty at St. Al's Hospital emergency room. Most of the patients you see in the emergency room have cuts that you believe are serious enough to require an injection of a particular drug. Although you don't give the patient the injection yourself, you must decide how much serum to use.

II. STEPS

You compute the dosage based on 3 milligrams of medication per kilogram of patient's weight. The medicine you use comes in a concentration of 50 milligrams per milliliter of solution. You must make several computations in order to get the correct dosage. It is extremely important that the dosage be correct. This is the list of your patients and their weights. One dosage has been calculated as an example. Complete the list.

Name	Weight		Dosage	
	lbs	kg	D mg	D ml
Allen	144	65.45	196.35	3.9
Beth	120			
Carla	100			
Dave	165			
Fred	57			

Example:

Weight: $Kg = \frac{lbs}{2.2} = \frac{144}{2.2} = 65.45$

Dosage: $D\ mg = 3 \times Wt. = 3 \times 65.45 = 196.35\ mg$

$$\frac{D\ mg}{D\ ml} = \frac{50\ mg}{1\ ml}$$

$$D\ ml = D\ mg \div 50 = 196.35 \div 50$$
$$= 3.927\ ml = 3.9\ ml$$

RECOMMENDATIONS

MATERIALS

GRADE 8-K 2

SUBJECT Math

CLUSTER Health Occupations

JOB TITLE Lab Technician

CONCEPT

Percent concentration, ratios

PERFORMANCE OBJECTIVE

The student will be able to calculate and measure the amount of water to be added to a given quantity of medicine in order to arrive at the desired concentration.

ACTIVITY

I. SITUATION

You are the director of laboratory services for a large city hospital. Many medicines come to you in concentrated form, and you must mix and dilute them as required by the doctors who treat the patients in your hospital. You have two concentrated solutions, red and blue, and you must measure and mix them with water to form 500 ml each of three different medicines:

1) 500 ml of 10% red
2) 500 ml of 4% blue
3) 500 ml of 3% red and 14% blue

II. STEPS

1) You must calculate the quantity of each concentrate required in each solution.

2) You must measure and mix the required amount of concentrate and water.

3) The percentages and total volumes can be varied for other problems.

RECOMMENDATIONS

MATERIALS

Metric graduated cylinders, food coloring to make up the concentrates

MATERIALS

GRADE 8-M

SUBJECT Math

CLUSTER Agri-Business

JOB TITLE Nurseryman

CONCEPT

Percentage

PERFORMANCE OBJECTIVE

Upon the satisfactory completion of the percentage unit, the student will be able to accurately determine a 20% sales discount and a 3% sales tax on a landscape bill of nursery stock by using the percentage activity.

ACTIVITY

I. SITUATION

A nurseryman makes out a bill for a landscape contractor who receives a 20% discount in price for nursery stock. The contractor buys:

3 upright yews at $12.50 each
2 Colorado blue spruce at $28 each

II. STEPS

Determine the:

1) total cost of the yews and spruces before discount

2) amount of discount in price (20% times step #1)

3) total cost after discount (step #1 minus step #2)

4) actual amount paid including 3% sales tax (C + 3% x C)

RECOMMENDATIONS

MATERIALS

MATERIALS

GRADE 8-N

SUBJECT Math

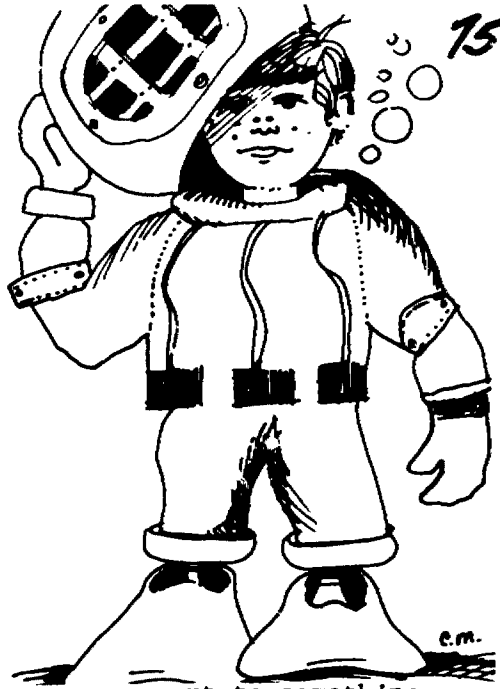
CLUSTER Marine Science

JOB TITLE Ship's Navigator

ACTIVITY

I. SITUATION

You have heard that primitive navigators sailing in canoes and modern supersonic aircraft navigators can determine their location by observing stars. You can determine your latitude very easily by a simple observation you can make on any clear night if you know where to find Polaris, the north star.



CONCEPT

Angle measures, celestial body identification and observation, latitude

PERFORMANCE OBJECTIVE

The student will be able to identify Polaris, the pole star, and will be able to determine latitude by a simple astronomical observation.

II. STEPS

1) First, you need to know what latitude means. Your latitude is your distance from the equator measured in degrees. The equator is 0^{o} latitude. The north pole is 90^{o} north latitude and the south pole is 90^{o} south latitude.

2) Second, you need an angle measuring device which you can convert to something similar to a navigator's sextant. Figure 1 shows how to make your sextant and how to measure star altitudes. When you read the angle on your protractor, you will notice that you must subtract the angle you read from 90^{o} to get your latitude no matter where you are in the northern hemisphere. At the north pole, Polaris is straight overhead, so your string should fall across 0^{o}. Thus $90^{o} - 0^{o} = 90^{o}$ latitude. At the equator (0^{o} latitude) the protractor would be horizontal for a 90^{o} reading at the string.

3) Polaris is one of the easiest stars to locate. It is within one degree of north of every place on earth at all times. See if you can memorize figure 2 and locate it. Hold the chart with the month at the top at midnight for a look at how the northern sky should appear.

(Figure 1 and figure 2 on the next page)

RECOMMENDATIONS

MATERIALS

Protractor and string
Reference: Dutton's Navigation and Piloting, United States Naval Institute, Annapolis, Maryland.

MATERIALS

GRADE 8-N

SUBJECT Math

CLUSTER Marine Science

JOB TITLE Ship's Navigator

ACTIVITY

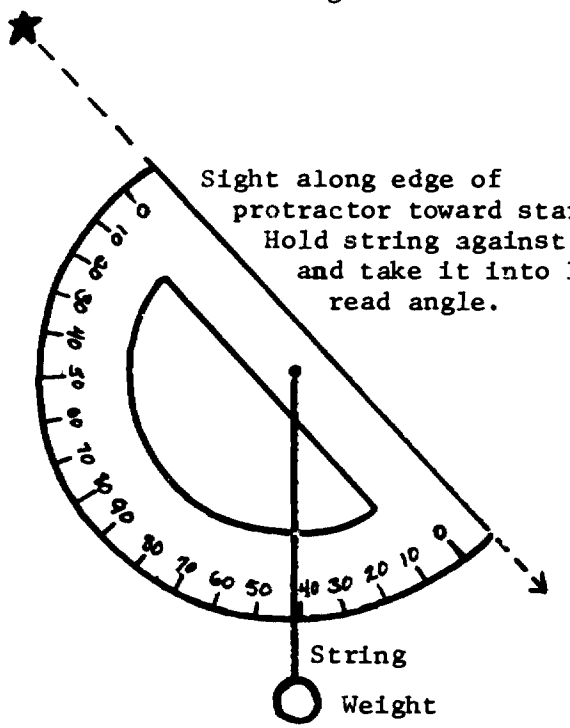


FIGURE 1

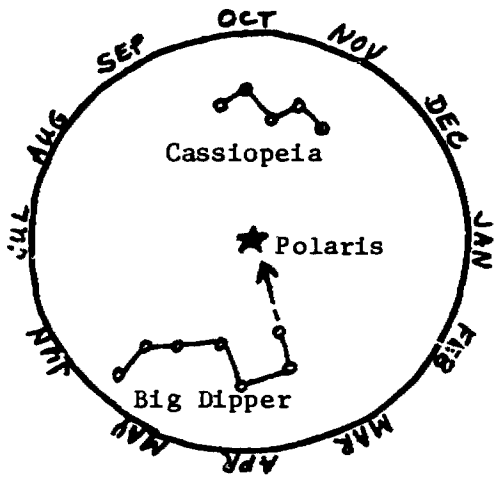


FIGURE 2

GRADE 8-0

SUBJECT Math

CLUSTER Marketing

JOB TITLE Outside Salesperson

CONCEPT

Simple Percentages

PERFORMANCE OBJECTIVE

The student will demonstrate knowledge of simple percentages used to compute sales commissions as measured by a written examination, passing with a score of 90%.

RECOMMENDATIONS

ACTIVITY

I. SITUATION

Student is an outside salesperson representing a local radio station selling advertising time to businesses. Student is paid a guaranteed salary every month of $600; however, if student sells over a total of $1,000 worth of advertising, he/she will be paid 10% of all sales.

II. STEPS

Over a three-month period, the salesperson has the following record of sales. Determine his/her paycheck for the month.

Month of May:

Client	Minutes Sold	Rate per Minute	Total
General Pants Co.	200 (remote spot)	6.80	$1,360
Spectra Productions	10	5.40	54
Bon Marche	10	6.80	68
Brookovers	20	5.40	108
Gary's Stereo	20	5.00	100
Monthly Totals	260		$1,690

MATERIALS

GRADE 8-P

SUBJECT Math

CLUSTER Construction

JOB TITLE Architect
Designer
Planner

CONCEPT

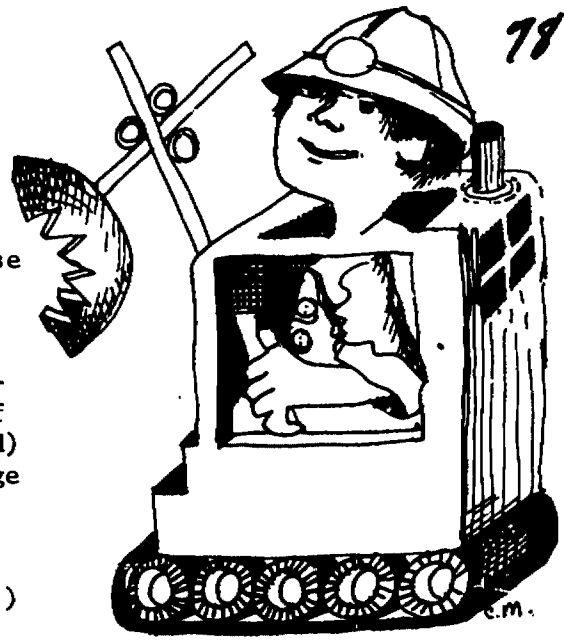
Area, volume, scale drawing

PERFORMANCE OBJECTIVE

The student will be able to compute the volume of material required and cost of material for a patio construction job. He will prepare a scale drawing of the project.

ACTIVITY

I. SITUATION



You are an architect and you are planning a patio for a customer. The customer has decided that he wants a patio in the shape outlined in figure 1. The flower bed and tree require that you leave those spaces without concrete bottoms. (They are not concrete boxes filled with dirt, but are holes in the concrete.) You decide that the concrete slab should be 6" thick. You must prepare a scale drawing to present to your customer with an estimate of material cost. Concrete (ready mixed and delivered) costs $22 per cubic yard, with a $10 delivery charge if you buy less than 5 cubic yards.

II. STEPS

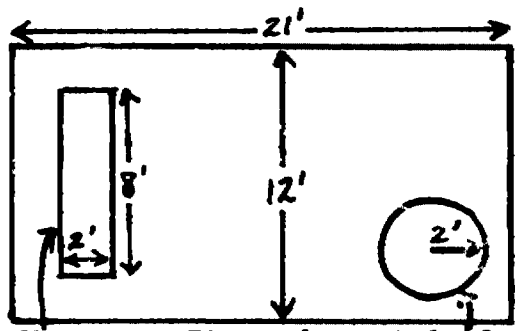
1) Prepare a scale drawing. (Suggestion: ½" = 1')

2) Compute surface area and volume.
Area = 12 X 21 - 2 X 8 - π X 4 = 252 - 16 - 12.56
= 223.44 square feet
Volume = area X thickness = 223.44 X ½
= 111.72 cubic feet

3) Convert to cubic yards. (1 cubic yard = 27 cubic feet)
Volume ≈ 111.72 ÷ 27 ≈ 4.14 cubic yards

4) If you need 4.14 cubic yards, you will a actually buy 5. Decide whether to decrease the size of the patio to 4 cubic yards (costing $88 + $10 = $98 total) or accept 5 cubic yards ($110 and no delivery charge) and use the extra concrete for some other job.

Note: Students should try other designs that they find pleasing. Check on current concrete costs.



flower bed — Figure 1 — hole for tree

RECOMMENDATIONS

MATERIALS

GRADE 8-P 2

SUBJECT Math

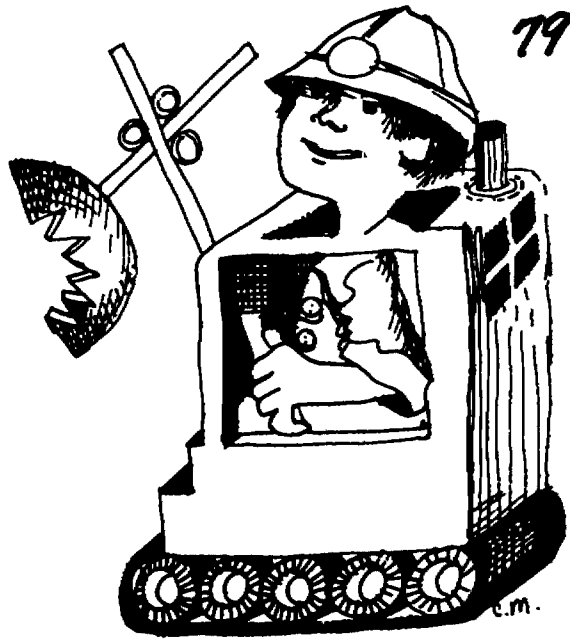
CLUSTER Construction

JOB TITLE Painter

ACTIVITY

I. SITUATION

The four walls of the room are to be painted.



CONCEPT

Area, decimals, measurement

PERFORMANCE OBJECTIVE

Upon the satisfactory completion of the activity, the student will be able to accurately calculate the wall surface area of the room to be painted and the cost involved in painting the room.

II. STEPS

1) Have students determine the wall area to be painted.

2) Have students determine the number of gallons of paint to be used.

3) Have students determine the cost of the paint if a gallon of paint covers 425 square feet and costs $7.25.

RECOMMENDATIONS

MATERIALS

MATERIALS

GRADE 9-A (1)

SUBJECT Math

CLUSTER Home Economics

JOB TITLE Home Ec. Teacher
Consumer

CONCEPT

Converting U.S. units to metric measures.

PERFORMANCE OBJECTIVE

Given a U.S. measurement, the student will write the equivalent metric measure. Given a metric measure, the student will write the corresponding U.S. measure.

I. SITUATION

The United States is slowly converting its measurements to the metric system. Every consumer should be made aware of the different metric equivalencies. Quite often a U.S. unit of measure can be written in two different terms in the metric system. They are either grains or liters (weight or volume).

II. STEPS

1) Study both systems of measurement below:

1 teaspoon (tsp) - - - - - 5 grams (g)
or 5 milliliters (ml)
1 Tablespoon (Tbsp) - - - - -15 g or 15 ml
1 Cup (C) - - - - - 240 g or 240 ml
2 C - - - - - 480 g or 480 ml- - - - -16 ounces
1 pint
4 C (2 pints, 1 quart (qt)) - - - - - 960 g or
960 ml
4 qts = 1 gallon - - - - - 4 l
1 pound (1 lb) - - - - - 5 Kg

2) Write the U.S. measures to metric measures and then the metric to the U.S.

(a) 3 tsp = _____ ml

(b) ½ C = _____ g

(c) ½ gal = _____ ml

(d) 1½ Tbsp = _____ g

(e) 2½ C = _____ g

(f) 720 g = _____ C

RECOMMENDATIONS

MATERIALS

Reference: Focus on Food, pg. 400.

MATERIALS

GRADE 9-A (1)

SUBJECT Math

CLUSTER Home Economics

JOB TITLE Home Ec. Teacher
Consumer

(g) 45 g = _____ Tbsp

(h) .25 Kg = _____ lbs

(i) 960 ml = _____ pints

(j) 7.5 g = _____ tsp

3) Knowing the following:

1000 g = 1 Kilogram (Kg)
500 g = .5 Kg
250 g = .250 Kg

Write the following measures from Cups to grams to Kilograms.

Example: 1 C = 240 g = .240 Kg

(a) 2 C = _____ = _____

(b) 2½ C = _____ = _____

(c) 4 C = _____ = _____

(d) 3¼ C = _____ = _____

GRADE 9-A-2

SUBJECT Math

CLUSTER Home Economics

JOB TITLE Home Ec. Teacher
Consumer

CONCEPT

Converting U.S. units of measure to metric measures.

PERFORMANCE OBJECTIVE

Given a U.S. measure, the student will write the equivalent metric measure. Given a metric measure, the student will write the corresponding U.S. measure.

ACTIVITY Page 1 of 2

I. SITUATION

A home economics teacher has a metric cake recipe. For a class demonstration, she compares the metric recipe to an equivalent U.S. recipe.

II. STEPS

1) Study the metric activity _____.

2) Write metric cake recipe, using U.S. measures. (Approximate when necessary.)

Example: 500 g flour = 2 C + 1 T flour

500 g flour - - - - _____

250 g sugar - - - - _____

10 g baking powder - - - - _____

5 g salt - - - - _____

120 g shortening - - - - _____

5 ml vanilla - - - - _____

5 egg yolks

120 ml milk - - - - _____

45 ml milk - - - - _____

3) Which types of measurements use liters? Which use grams?

4) Rewrite the U.S. measured recipe below in terms of the metric.

Quick Cocoa Cupcakes

½ C shortening - - - _____

½ C sifted cocoa - - - _____

1 C milk - - - _____

RECOMMENDATIONS

Review metric equivalents on overhead. Give examples of approximations.

MATERIALS

Reference: Focus on Food, pg 400. Metric measuring cups and spoons.

MATERIALS

GRADE 9-A-2

SUBJECT Math

CLUSTER Home Economics

JOB TITLE Home Ec. Teacher
Consumer

ACTIVITY Page 2 of 2

1½ C flour - - - _____

1 tsp baking soda - - - _____

1 tsp salt - - - _____

1 1/3 C sugar - - - _____

2 eggs

1 tsp vanilla - - - _____

GRADE 9-A-3

SUBJECT Math

CLUSTER Home Economics

JOB TITLE Homemaker
Restaurant Cook

CONCEPT

Multiplication of fractions

PERFORMANCE OBJECTIVE

The student will substitute a given baking ingredient for an equivalent one and then multiply it to fit a recipe.

ACTIVITY

I. SITUATION

The student is a homemaker who is baking brownies. The homemaker discovers that he has no unsweetened chocolate. Instead of running to the store for the item, he looks up in a cookbook under substitution and finds that one ounce square of chocolate equals three tablespoons of cocoa plus one tablespoon of shortening. If the recipe calls for three squares of chocolate, what amounts will he substitute in?

3 sq = 3(3T) cocoa + 3(1T) shortening

3 sq = 9 T cocoa + 3 T shortening

According to cookbook substitutions 8 T = ½ C, so

3 sq = ½ C + 1 T cocoa + 3 T shortening

II. STEPS

1) Study the list below of common cooking substitution values:

Baking powder - - - 1 tsp = ¼ tsp baking soda + ½ tsp cream tartar

Chocolate - - - 1 ounce sq = 3 T cocoa + 1 T shortening

Cornstarch - - - 1 T = 2 T flour

Honey - - - 1 C = 3/4 C sugar = ¼ C liquid

Eggs - - - 1 egg = ½ t baking powder

2) Change the asked-for ingredients to the substituted values above:

Example: 3 t baking powder = 3(¼T) + 3(½ tsp c.t)
= 3/4 T + 3/2 tsp cream tartar

RECOMMENDATIONS

Have cookbooks available for student references.

MATERIALS

MATERIALS

GRADE 9-A-3

SUBJECT Math

CLUSTER Home Economics

JOB TITLE Homemaker
Restaurant Cook

(a) 2 C honey

(b) 3½ T cornstarch

(c) 3 ounces chocolate

(d) 2½ tsp baking powder

(e) 2 eggs

(f) 1½ C honey

GRADE 9-A-4

SUBJECT Math

CLUSTER Home Economics

JOB TITLE Consumer

CONCEPT

Percents
Decimals

PERFORMANCE OBJECTIVE

(a) The student when given the label from a package of hamburger, will figure the quantity of fat within the package.

(b) He will then proceed to figure the cost per ounce for meat and the best buy.

RECOMMENDATIONS

Bring in guest lecturer who is a butcher.

ACTIVITY Page 1 of 2

I. SITUATION

Any consumer purchasing hamburger can figure the quantity of fat within the package by reading the percentage on the label. It may read 10%, 15%, 20%, 30% or 40%. Once he knows the quantity of fat in the package it is possible to figure the true amount of meat and then the best price.

II. STEPS

1) Study current newspaper ads to find the prices of various types of ground beef (hamburger).

2) Figure the quantity of fat in the given labels below.

Example: 1 lb at $ .88 - - - 20% fat
1 lb = 16 ounces
20% = .20

$$\begin{array}{r} 16 \text{ ounces} \\ \times\ .20 \\ \hline 3.20 \text{ ounces of fat} \end{array}$$

(a) 1 lb at $1.09/lb - - - 15% fat

(b) 1 lb at $ .79/lb - - - 30% fat

(c) 1 lb at $ .95/lb - - - 20% fat

(d) 1 lb at $1.29/lb - - - 10% fat

3) How many ounces of meat are in the packages of meat in problem (2)?

Example: 1 lb at $ .88/lb - - - 20% fat

fat = 3.2 ounces

meat = 16.0 ounces

$$\begin{array}{r} 3.2 \\ \hline 12.8 \text{ ounces of meat} \end{array}$$

MATERIALS

Room set of papers

MATERIALS

GRADE 9-A-4

SUBJECT Math

CLUSTER Home Economics

JOB TITLE Consumer

ACTIVITY Page 2 of 2

4) What was the actual price per ounce of meat in problem (3)?

Example: Actual Price = price per pound ÷ ounces of meat

Actual price = $12.8 \overline{)\ .8800}$ (.068)

$\frac{768}{1120}$ = .068 or .07 per ounce

5) Which pound of meat in problem (2) was the best buy?

GRADE 9-A5

SUBJECT Math

CLUSTER Consumer Education

JOB TITLE Retail Buying

CONCEPT

Mathematic skills needed for consumer protection.

PERFORMANCE OBJECTIVE

1) The student will demonstrate comprehen ion of precise wording of Retail Buying contracts by completing the activity with a minimum of 70% accuracy on the math portion of the activity.

2) The student will understand the value of precise wording on Retail Buying contracts, as measured by his/her participation in a group discussion following the math portion of the activity.

ACTIVITY

I. SITUATION

The student is a consumer about to buy a new couch. The decision which faces the consumer is which credit plan to use in purchasing the couch. Two options are available: Bank Americard, charging 1½% per month of the declining balance or the funiture company's plan which is figured at 1½% per month. The problem is below.

II. STEPS

The furniture store salesman wants the consumer to use the handy "Carl's Cozy Couches Credit Card" plan. He explains to the consumer that 1½% is 1½%; so why not use the Carl's Plan to save the Bank Americard for other things?

What he does not tell the student is that "Carl's Cozy Couches Credit Card" charges 1½% per month of the purchase price, not the declining balance.

The student will compute the total cost of the couch (original price $1,000.00) over a twelve-month period of time using the Carl's Plan and the Bank Americard Plan.

RECOMMENDATIONS

MATERIALS

MATERIALS

GRADE 9-A 6

SUBJECT Math

CLUSTER Home Economics

JOB TITLE Homemaker

CONCEPT

Computations of costs using formulas.

PERFORMANCE OBJECTIVE

The student will be able to compute the dimensions and cost of fabric required to make draperies with 80% accuracy on sample problems provided by the teacher.

A12

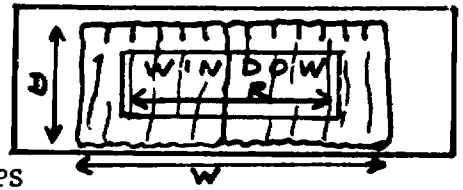
RECOMMENDATIONS

Suggested additional activity: measure the window in the classroom and compute material required and cost of drapes.

ACTIVITY

I. SITUATION

The student is buying a new home and wants to make draperies for the windows. Given a house plan, the student will determine window dimensions and decide on what kind of draperies to use based on costs.



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II. STEPS

For each window, the student will:

1) Determine window dimensions.

2) Decide on length of material required (L).
   a) Normally, length will be 84".
   b) Add 15" for hems to compute material length. Since L = total material length and D = desired drapery length, L = D + 15.

3) Decide on drapery width (W).
   a) Add 20" to width. Since W = total width of draperies and R = width of the window, W = R + 20.
   b) Normal drapery material width is 45" to 48". To determine how many widths of material are needed, divide width by 20. N = W ÷ 20. This will allow enough material for pleats, returns, and overlaps.

4) Determine cost of material (C).
   a) Multiply length (L) in step #2b by the number of widths (N) in #3b to find the total length required. T = L x N when T = total material length in inche
   b) Convert total length to yards. When Y = total length in yards, Y = T ÷ 36.
   c) Compute cost of material from price list provided by teacher. C = P x Y when C = cost of material and Y = price per yard.

MATERIALS

Sample price list, house plan showing window sizes

MATERIALS

GRADE 9-B/

SUBJECT Math

CLUSTER Industrial Arts

JOB TITLE Diesel Mechanic
Automotive Engineer
Mechanical Engineer

CONCEPT

Ratios, functions

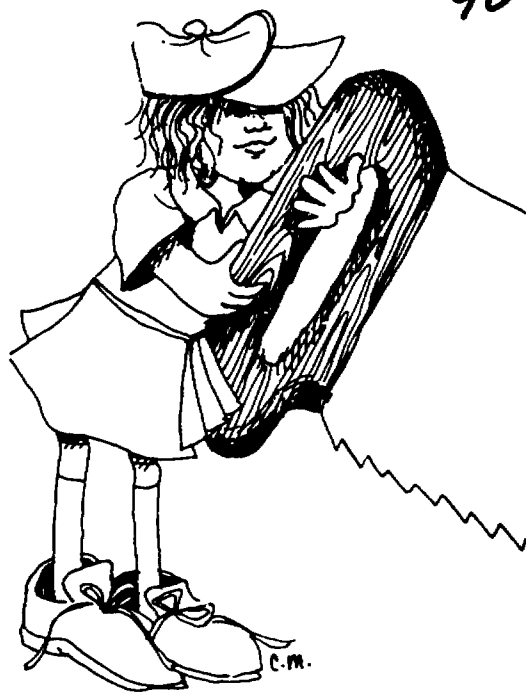
PERFORMANCE OBJECTIVE

Upon completion of the activity the student will be able to calculate single ratios based on Boyle's Law (ideal gas law) to a 90% degree of accuracy.

RECOMMENDATIONS

ACTIVITY Page 1 of 2

I. SITUATION



The diesel engine is the most economical engine to operate in terms of the energy that can be put to use from a given quantity of fuel. That is, it can extract more energy from a pound of fuel than can a steam engine or a gasoline engine. There are drawbacks, however. In a gasoline engine, the pressure in the cylinders is quite a bit lower than in the diesel because the gasoline engine uses spark plugs to ignite the fuel-air mixture. In the diesel, the heat for ignition is supplied by very highly compressing the air. The pressures in the diesel are nearly twice that for a gasoline engine and, therefore, the engine must be stronger to withstand the higher pressures. Some other advantages of the diesel engine over the gasoline eingine are that there is no carburetor, no spark plugs, no timing or tune-up problems. You are a diesel mechanic, and you are checking the compression on an engine.

II. STEPS

1) You know that the compression ratio for old gasoline engines was about 4:1 and that for modern gasoline engines is 6.5:1 to 9:1; but diesel engine compression ratio is about 19:1. Compression ratio is illustrated in figure 1 a and b. Assuming that the temperature stays constant during the compression cycle, knowing the four compression ratios given above and that normal atmosphere pressure is 14.7 pounds per square inch (P_1), complete the chart in figure 2 (figure 1 and 2 on next page).

(continued)

MATERIALS

MATERIALS

GRADE 9-B/

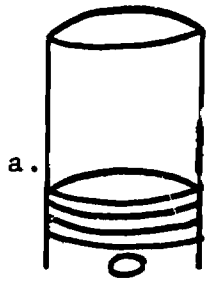
SUBJECT Math

CLUSTER Industrial Arts

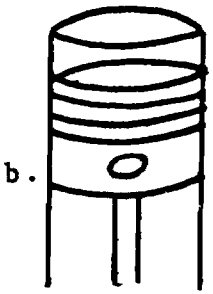
JOB TITLE Diesel Mechanic
Automotive Engineer
Mechanical Engineer

II. STEPS

2) Find P_2 (the pressure of air in the cylinder before ignition of the fuel) if $P_1V_1 = P_2V_2$.



Piston down, volume of air at maximum (V_1).



Piston at top of stroke, volume at smallest (V_2).

Compression ratio: $V_1:V_2$ or $\frac{V_1}{V_2}$

FIGURE 1

P_1	$\frac{V_1}{V_2}$ (compression ratio)	P_2 (ANS)
14.7	$\frac{4}{1}$ (model T Ford)	(58.8)
14.7	$\frac{6.5}{1}$ (regular gasoline)	(95.55)
14.7	$\frac{9}{1}$ (premium gasoline)	(132.3)
14.7	$\frac{19}{1}$ (diesel)	(279.3)

$P_2 = \frac{P_1V_1}{V_2}$

$P_2 = P_1$ X compressio ratio

FIGURE 2

GRADE 9-B 2

SUBJECT Math

CLUSTER Industrial Arts

JOB TITLE Electronics Technician

CONCEPT

Graph relations, functions.

PERFORMANCE OBJECTIVE

The student will be able to find the relationship between current and voltage in a simple electric circuit with one active element.

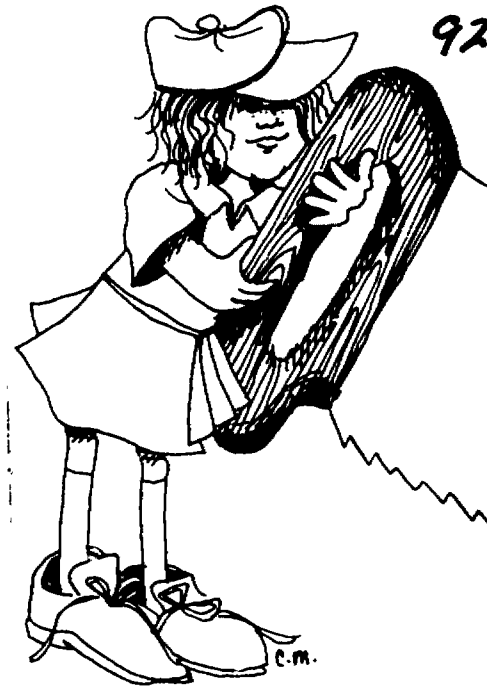
RECOMMENDATIONS

ACTIVITY Page 1 of 2

92

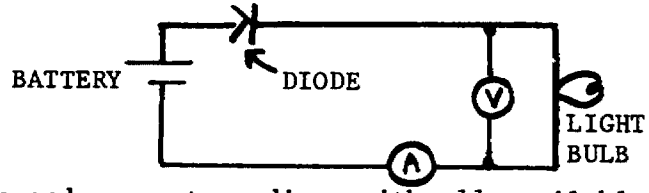
I. SITUATION

You are a scientist employed by a national research laboratory. You have invented a device that seems to operate in a new, interesting manner. You are now making measurements to help you explain the operation of your device to your boss.



II. STEPS--Recommended Approach

1) Hook up the circuit as shown:



Make voltage and current readings with all available battery voltages.

2) Reverse polarity of the batteries and make a second complete set of voltage and current readings. Record test results on the form on the following page and plot the voltage and current on Cartesian coordinates.

3) Remove the diode from your circuit and repeat the entire experiment.

4) Construct what you believe is a good explanation of what happened in the circuit element.

5) Tell in your own words how you would describe this wonderful device to your boss as you ask for a raise.

MATERIALS

4 1½-volt batteries, 6-volt bulb, sold state diode, volt meter, ammeter

MATERIALS

GRADE 9-B 2

SUBJECT Math

CLUSTER Industrial Arts

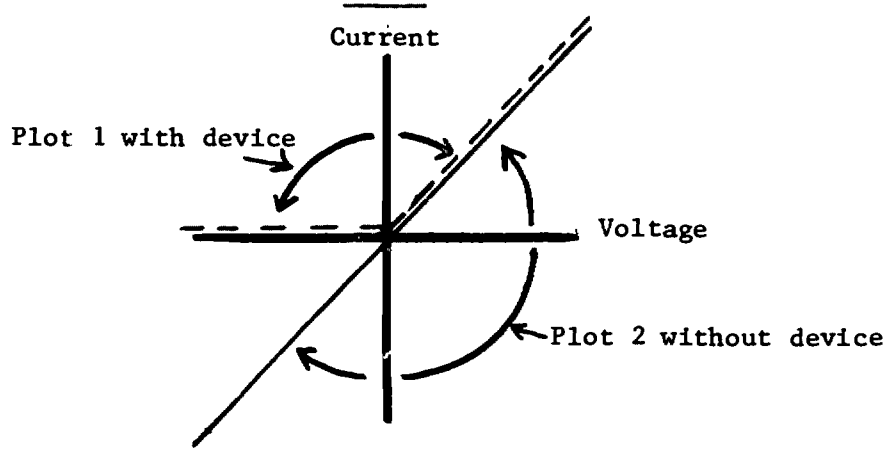
JOB TITLE Electronics Technician

ACTIVITY Page 2 of 2

II. STEPS

With Device in Circuit		Without Device	
Voltage	Current	Voltage	Current
1½			
3			
etc.			
	With Batteries Reversed		
1½			
3			
etc.			

GRAPH



GRADE 9-B[3]

SUBJECT Math

CLUSTER Industrial Arts

JOB TITLE Power Mechanics

CONCEPT

Geometry: study of the volume of a cylinder.

PERFORMANCE OBJECTIVE

The student will be able to figure the cubic inch displacement of an engine. To do this, he will apply geometric concepts of measuring diameters (bore) and height (stroke) and applying these in the formula for the volume of a cylinder.

ACTIVITY

I. SITUATION

The student is a power mechanic who is figuring the cubic inch displacement of a lawn mower motor. First, the mechanic must measure carefully the diameter of the piston (bore) using a micrometer or scale. Next, he will measure the distance that the piston moves up and down in the cylinder (stroke). Lastly, he will substitute these figures into the formula: displacement = $\pi R^2 h$. This displacement figure is the key value needed by a mechanic to evaluate the efficiency of any engine.

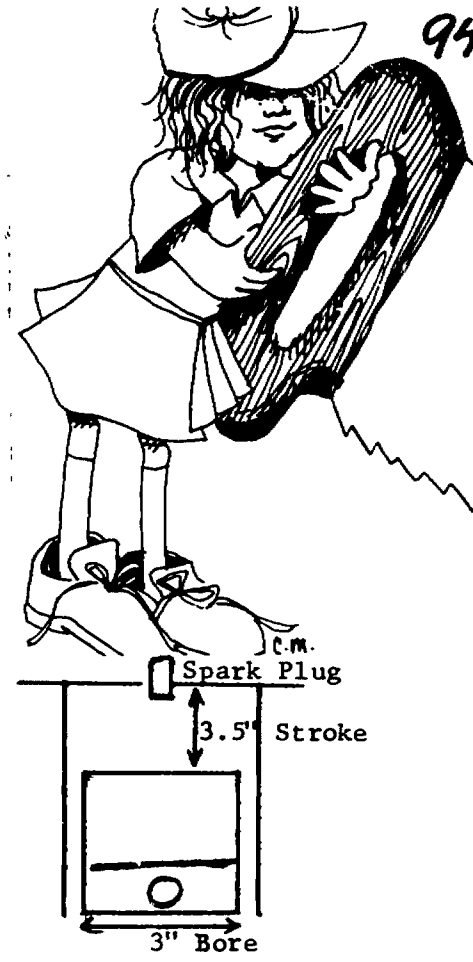
II. STEPS

1) Present in the classroom should be some old motors (lawn, boat, etc.). The student will first measure the diameter of the piston to either the nearest thousandth if the class has a micrometer or to the nearest thirty-second if they have scales. This measure is called the bore.

2) Measure next the distance the piston moves up and down the cylinder. Again, use the type of scale available and be as careful as possible. This measure is called the stroke.

3) Substitute the two measures into the formula: displacement = πR^2 (1/2 bore measure) X h (stroke).

4) What would be the displacement of a motor if:
   a) bore = 2"
      stroke = 2.5"
   b) bore = 3 1/4"
      stroke = 3 1/8"



Displacement = $\pi R^2 h$
(R = radius = 1/2 bore)
= $(3.14)(1.5)^2(3.5")$
= $(3.14)(2.25)(3.5")$
D = 24.7275 cubic inches

RECOMMENDATIONS

Obtain old lawn motors. Take off the head and let the student do the measurements.

MATERIALS

Room set 6" scale, micrometer (if possible)
Reference: Exploring Power, page 24.

MATERIALS

CODE 9-B-4

SUBJECT Math

CLUSTER Industrial Arts

JOB TITLE Power Mechanic

CONCEPT

Geometry: replacement of values into a formula.

PERFORMANCE OBJECTIVE

The student will be able to compute the horsepower of an engine by substituting values into a standard formula.

ACTIVITY

I. SITUATION

The student is a car mechanic who is figuring the horsepower of an engine. After measuring the bore of the piston (see activity 9-B-1) and counting the number of cylinders the engine has, he substitutes the figures into this formula: horsepower = $\frac{D^2N}{2.5}$

D = measure of bore
N = number of cylinders
2.5 = mathematical constant

II. STEPS

1) Example: What is the horsepower of a Chevrolet V-8 327 with a 3 1/4" bore?

$$Hp = \frac{(3\ 1/4")(3\ 1/4")(8)}{2.5}$$

Hp = 33.8 square inches

2) Using the same motor and information available in activity 9-B-1, what will be the horsepower of the motor?

3) What will be the horsepower of the following motors?
   a) bore = 2 1/2"
      cylinders = 2
   b) bore = 3"
      cylinders = 1
   c) bore = 3 3/8"
      cylinders = 6
   c) bore = 2 3/4"
      cylinders = 7

RECOMMENDATIONS

Use the same motor used in activity 9-B-1. Work up a transparency of an example horsepower problem.

MATERIALS

Reference: Exploring Power, page 25.

MATERIALS

GRADE 9-B5

SUBJECT Math

CLUSTER Industrial Arts

JOB TITLE Carpenter

CONCEPT

Pythagorean Theorem (right triangles)

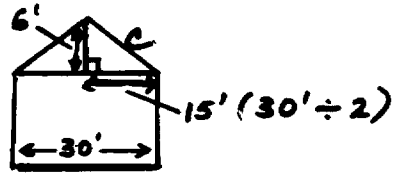
PERFORMANCE OBJECTIVE

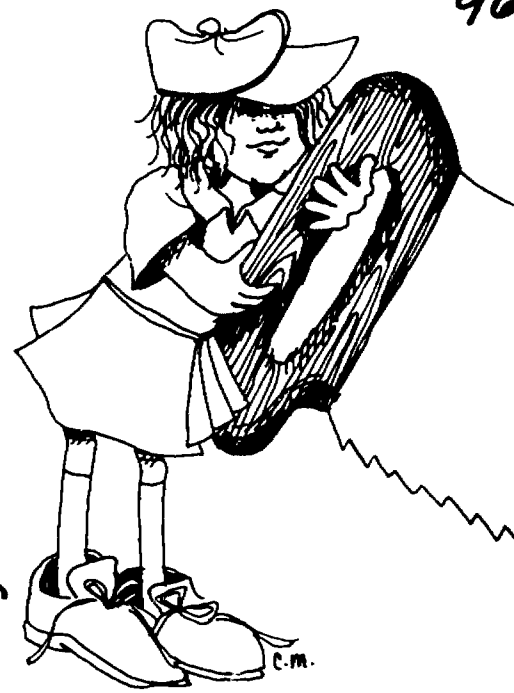
Upon satisfactory completion of the carpentry activity, the student, when given the width of the house and the height of the roof, will be able to compute the length and slope of the roof by applying the Pythagorean Theorem.

ACTIVITY

I. SITUATION

A carpenter must compute the amount of wood needed for the slanted portion of a house's roof. He first must measure the width of the house, then the height of the desired roof. After he gets these measurements, he plugs them into the right triangle formula (Pythagorean Theorem). Example:





Pythagorean Theorem = $a^2 + b^2 = c^2$

(two shortest legs; hypotenuse)

Slanted side: $c^2 = 6^2 + 15^2$

$= 36 + 225$

$= 261$

Take the square root of both sides: $\sqrt{c^2} = \sqrt{261}$; c = 16.1 feet

II. STEPS

1) A carpenter needs to know the length of the slanted portion of a roof. The house is 28 feet wide and the height of the roof is 5 feet. Find the length of the slanted portion of the roof.

2) You are building a doghouse. The width of the house is 4 feet and the height of the roof is 2 feet. How long will be the slanted portion of the roof?

3) Measure the width of your home; then measure or estimate the height of your roof. Now compute the length of the slanted portion of the roof

RECOMMENDATIONS

MATERIALS

MATERIALS

E 9 - B 6

SUBJECT Math

CLUSTER Industrial Arts

JOB TITLE Diesel Mechanic
Automotive Engineer
Mechanical Engineer

CONCEPT

ratios, functions

PERFORMANCE OBJECTIVE

The student will be able to use simple ratios to calculate missing terms in the expression

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

Upon the satisfactory completion of the diesel, automotive & mechanical unit, the student will be able to satisfactorily calculate simple ratios in determining missing items from the above equation

RECOMMENDATIONS

ACTIVITY

I. SITUATION

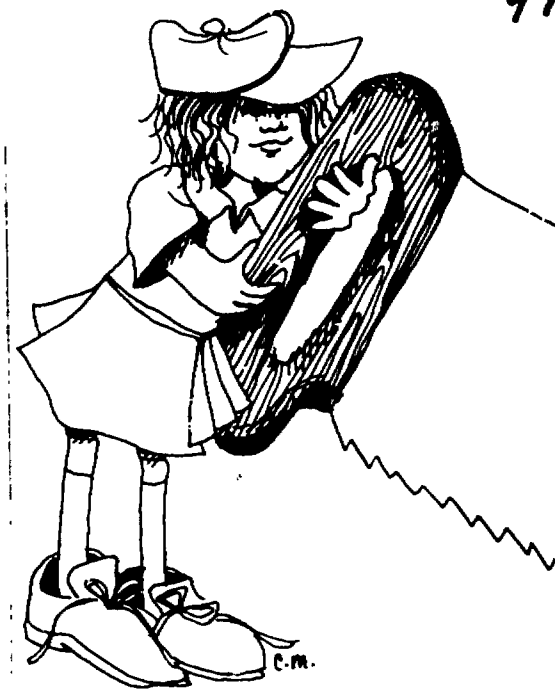
See 8th grade activity #

Using the perfect gas law $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$,

where T_1 & T_2 must be expressed in degrees absolute, and knowing that the compression ratio of a diesel engine is approximately 19:1, calculate P_2 (pressure in cylinder after compression).

II. STEPS

P_1 and T_1 are standard atmospheric pressure and temperature (P_1 = 14.7 psi, T_1 = 20° C = 293° K) and that T_2 must be at least 450° C (723° K). Complete the following chart:



T_1	P_1 psi	$\frac{V_1}{V_2}$	T_2	P_2 psi (Ans.)
20°C, 293°K	14.7	19/1	450°C, 723° K	(689)
" "	"	"	500°C, 773° K	(737)
" "	"	"	550°C, 823° K	(785)
" "	"	18/1	450°C, 723° K	(653)
" "	"	"	500°C, 773° K	(698)

Compare with pressure ratios if T remains constant (P_2 = 279 psi for 19:1 comp.ratio

MATERIALS

GRADE 9-C'

SUBJECT Math

CLUSTER Arts and Humanities

JOB TITLE Fine Artist

ACTIVITY

I. SITUATION

You have a matted picture which is 18" X 24", and you want to construct a 3" frame with 45° corners and a 1/4" groove to hold the picture.

CONCEPT

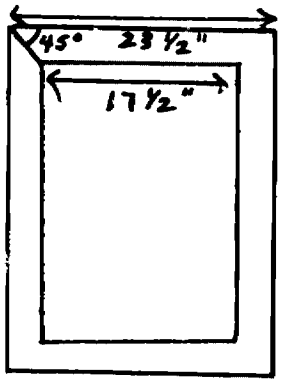
Using a ruler, angles, construction

PERFORMANCE OBJECTIVE

Given a matted picture, students will determine the frame's measurements.

II. STEPS

1) Determine the length of each side, both outside lenth and inside length.
   a) Solution to one side:



2) Determine the cheapest way to cut a 6" board for this frame.

RECOMMENDATIONS

MATERIALS

MATERIALS

CODE 9-C2

SUBJECT Math

CLUSTER Arts and Humanities

JOB TITLE Potter

CONCEPT

Percentage

PERFORMANCE OBJECTIVE

Given a percentage composition for a certain glaze, the student is to determine the amount of each component.

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ACTIVITY

I. SITUATION

A student has the components for P.V.C., a shiny glaze. He/she wants to mix a certain greenish-blue glaze which has the following percentage composition:

Plastic Vitrox--56.5%
Colemite--39.2%
Cobalt Carbonate--2.4%
Copper Carbonate--1.9%

II. STEPS

Determine the amount of each component needed for 175 grams of the glaze.

a) Plastic Vitrox = _____grams

b) Colemite = _____grams

c) Cobalt Carbonate = _____grams

d) Copper Carbonate = _____grams

RECOMMENDATIONS

MATERIALS

MATERIALS

GRADE 9-C 3

SUBJECT Math

CLUSTER Arts and Humanities

JOB TITLE Delineator

ACTIVITY

I. SITUATION

The student will construct on a 1:48 scale a house from his/her blueprint or obtain blueprints from a architect or contractor.

CONCEPT

Proportion

PERFORMANCE OBJECTIVE

The student will build a house accurately on a 1:48 scale (¼" to 1').

II. STEPS

1) Discuss with the students the jobs of an architect and draftsman; requirements for the positions, benefits, etc. Emphasize the relationships between these jobs and math.

   a) Information can be found in the counselors' offices on these and other occupational areas.

2) Define a delineator (a person who builds three-dimensional model scale homes from blueprint).

3) Build the house.

RECOMMENDATIONS

MATERIALS

Blueprint; drafting paper; building materials (balsa wood from a hobby shop); Exacto tools, such as saws to cut wood

MATERIALS

E 9-C 4

SUBJECT Math

CLUSTER Arts

JOB TITLE Macrame Artist

CONCEPT

1) Proportion

2) Percentage

PERFORMANCE OBJECTIVE

The student will determine the length of nylon cord needed to make a belt and calculate the total cost of the project.

ACTIVITY

I. SITUATION

A student wishes to make a macrame belt, with a buckle, 30 inches long.

II. STEPS

1) It takes 4 inches of cord to make 1 inch of belt. Determine the length of cord needed.

2) The belt is to be 8 cords wide. Determine the total cord needed for the belt.

3) The cord is nylon and costs 2¢ a foot. Determine the cost of the cord.

4) The state sales tax is 3%. Determine the actual cost of the cord, including tax.

RECOMMENDATIONS

MATERIALS

MATERIALS

GRADE 9-C5

SUBJECT Math

CLUSTER Arts and Humanities

JOB TITLE Potter

CONCEPT

Division of percentage

PERFORMANCE OBJECTIVE

Upon the satisfactory completion of the activity, the student will be able to accurately determine the correct size of a pottery lid prior to shrinkage by using the division of percentage.

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ACTIVITY

I. SITUATION

A potter is making a replacement lid for a jar which has a neck diameter of 18 cm. He can expect a 15% shrinkage in size in drying and firing.

II. STEPS

Determine the size of the wet clay lid needed to produce the 18 cm lid.

X = size of the wet clay lid

$X - 15\%X = 18$

$100\% - 15\%X = 18$

$85\%X = 18$

$.85X = 18$

$\frac{.85X}{.85} = \frac{18}{.85}$

$X = \frac{18}{.85}$

$X =$ ____

RECOMMENDATIONS

MATERIALS

MATERIALS

DE 9-D

SUBJECT Math

CLUSTER Business

JOB TITLE Banking

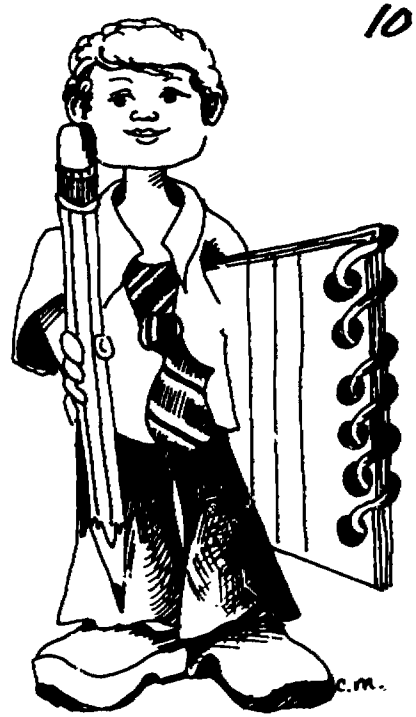
CONCEPT

Percentages, multiplication, addition, division.

PERFORMANCE OBJECTIVE

The student will demonstrate comprehension of the attached activity with a minimum of 70% accuracy.

ACTIVITY



I. SITUATION

Each student has $10,000 to invest. He/she goes to the local bank and approaches the teller for information on savings styles and interest rates. The teller explains the three options open to the investor:

1) Timed certificate of deposit--6% annually
2) Premium passbook--5½% compounded quarterly
3) Regular passbook--5% compounded quarterly

II. STEPS

1) The student will compute each style of interest to determine net return on investment of each savings style.

2) Computations will be determined as if no additional deposits or withdrawals were made during the year.

3) Subsequent computations will be based on hypothetical deposits and within a given quarter (90 days) as determined by instructor.

a) Note: All accounts are computed on the smallest balance in the account during the quarter.
b) Note: Do not attempt to figure T.C.D. with withdrawals during the quarter.

RECOMMENDATIONS

MATERIALS

Attached interest computations to be copied.

MATERIALS

104

PREMIUM PASSBOOK
INTEREST COMPUTATION

$10,000.00
x .055 = 5½%
$ 550.00 annual untouched rate

$137.50 = ¼ of annual interest
4/550.00

$10,000.00 original deposit
+ 137.50 = ¼ (90 days) of annual interest
$10,137.50 after first quarter

$10,137.50
x .055
$ 557.56 annual untouched rate

$139.39 = ¼ of annual interest
4/557.56

added to accrued balance of $10,137.50
+ 139.39
$10,276.89

$10,276.89
x .055 = 5½%
$ 565.22 annual untouched rate

$141.30 = ¼ of annual interest
4/565.22

$10,276.89 = accrued balance for previous quarter
+ 141.30 = quarterly annual interest
$10,418.19 = accrued balance

$10,418.19
x .055 = annual 5%
$ 573.00 annual untouched rate

$143.25 = ¼ of annual interest
4/573.00

$10,418.19 = accrued total from previous quarter
+ 143.25 = quarterly annual interest
$10,561.44 = final total

REGULAR PASSBOOK
INTEREST COMPUTATION

$10,000.00
x .05 = 5% interest
$ 500.00 ÷ by 4 (number of quarters in a year)

$125.00 = ¼ of annual interest
4/500.00

$10,000.00
+ 125.00 = ¼ of annual interest
$10,125.00 at end of first quarter

$10,125.00
x .05 = 5% interest
$ 506.25 ÷ by 4 (number of quarter in a year)

$126.56 = ¼ of annual interest
4/506.25

$10,125.00 = accrued balance forward
+ 126.56
$10,251.56

Etc.

$10,509.44 = Final Total

Note: T.C.D. = $10,600.00

GRADE 9-F

SUBJECT Math

CLUSTER Hospitality

JOB TITLE Hotel Manager

CONCEPT

Percentage

PERFORMANCE OBJECTIVE

1) Student will determine the break-even point using percentage.

2) Upon the satisfactory completion of the percentage activity, the student will establish the percent occupancy for a hotel unit and determine the break-even point over the information in the activity.

RECOMMENDATIONS

ACTIVITY

I. SITUATION

John, the manager at Roll Away Motor Inn, determines that the break-even point is 56.5% of occupancy. If the Roll Away has 120 rooms, determine how many have to be filled to make money.

II. STEPS

Determine the percent occupancy for the following days:

Monday: 70 rooms filled out of 120 rooms

Tuesday: 58 rooms filled out of 120 rooms

Wednesday: 75 rooms filled out of 120 rooms

Thursday: 45 rooms filled out of 120 rooms

Friday: 62 rooms filled out of 120 rooms

MATERIALS

GRADE 9 - I

SUBJECT Math

CLUSTER Manufacturing

JOB TITLE Chemist

CONCEPT

Ratios, rates of flow

PERFORMANCE OBJECTIVE

The student will be able to compute volume from rate of flow; he will be able to calculate the volume of two different concentrations of the same substance needed to get a desired concentration.

ACTIVITY

I. SITUATION

You are the production chief at a large chemical plant. You are frequently called on to calculate the required amounts of chemicals to be used in the final critical stages of the manufacturing process because of your great experience. You have a large mixing tank with two inlet pipes . One inlet pipe comes from Tank A, which contains 80% ethylene glycol and 20% water (by volume) The other inlet comes from Tank B which contains 10% ethylene glycol and 90% water. You don't have a meter to measure the volume passing through the pipes, but you do know the rate of flow through each pipe. The pipe from Tank A flows at a rate of 10 gal. per minute, and the pipe from Tank B, 15 gal. per minute. You need to prepare a chart showing your assistant how much of A and B to use to obtain various quantities of the mixture and how long to turn on the valves from A & B. Complete the chart following.

(CONTINUED)

RECOMMENDATIONS

MATERIALS

GRADE 9 - I
SUBJECT Math
CLUSTER Manufacturing
JOB TITLE Chemist

DESIRED MIX	VOLUME NEEDED	QUANTITY (GAL)		TIME	
		A (80%)	B (10%)	A(10gpm)	B(15gpm)
40%	100 gal	42 6/7	57 1/7	4m17s	3m49s
45%	100 gal				
80%	200 gal				
10%	1500 gal				
50%	300 gal				

Example:

For 40% solution, 100 gal.

.4 x 100 = 40 gal glycol, 60 gal water
let N = gal of 80% mixture
then 100 - N = gal of 10% mixture

.80N + .10(100-N) = 40 gal glycol
.8N + 10 - .1N = 40
.7N = 30
N = 300/7 = 42 6/7 gal of A

100 - N = 57 1/7 gal of B

T_A = time of flow from tank A

T_A = 42 6/7 divided by 10 = 4 2/7 min = 4 min 17 1/7 sec.

T_B = time of flow from tank B

T_B = 67 1/7 divided by 15 = 3 17/21 min = 3 min 48 4/7 sec.

Could you get a 90% mixture? Why or why not?

E 9 - 12

SUBJECT Math

CLUSTER Manufacturing

JOB TITLE Physicist
Electronics Engineer

CONCEPT

Exponents, scientific notation

PERFORMANCE OBJECTIVE

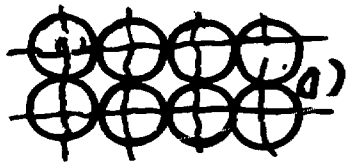
The student will be able to use exponential notation and scientific notation in multiplication and division.

ACTIVITY

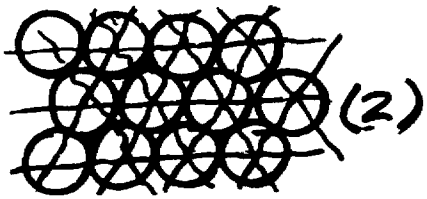
I. SITUATION

(See 7th Grade and 8th Grade units on same subject)

How were the layers of BB's packed in the previous exercises? They were packed like this:



They could be packed closer by using this plan:



This kind of packing is called "hexagonal close packed" and is found in many crystal structures. It is important to note that the present exercise is not how to pack electrons into a box, but to illustrate how dense matter such as electrons are thought to be. In the previous exercises the space was supposed to be filled as shown in illustration (1). The empty spaces between BB's in illustratic (2) seem to be smaller than in (1) and therefore should allow more to be packed into the same 1 cubic centimeter space. You have seen that in the relatively inefficient packing of illustration (1) about 4740 tons would be packed in. Now suppose that all the empty space could be filled, that is, all the electrons mashed like potatoes and packed in solid, how much would the 1 cubic centimeter weigh?

RECOMMENDATIONS

Volume of sphere= $4/3\ r^3$

R electron = 2.8×10^{-13} centimeters

M electron = 9.1×10^{-28} grams

1 gram = 2.2×10^{-3} lb

Answer: approximately 10,000 tons

MATERIALS

GRADE 9-J

SUBJECT Math

CLUSTER Transportation

JOB TITLE Airline Pilot

CONCEPT

Speed, distance, time computations, simple vector additions

PERFORMANCE OBJECTIVE

The student will be able to construct simple wind vector additions and compute times within 3 minutes for a simulated flight path 80% of the time as determined by the instructor.

ACTIVITY

I. SITUATION

You are an airline pilot with a route that takes you to several cities in the local area. Your aircraft flies at 360 mph and uses 1,800 gallons of fuel per hour. The wind is from the west at 75 mph. Using distances and directions provided by the teacher and polar coordinate paper, compute the wind-drift, ground speed, time and fuel required for at least one leg of the flight.

II. STEPS

For each leg of your flight:

1) Label graph paper with compass directions and speed rings (see figure 1).

2) Identify the desired ground track of the route of flight and plot on the chart.

3) Plot wind direction and magnitude.

4) Transfer wind direction and magnitude vector so that head of arrow is on desired course line and tail is on airspeed circle (360 mph circle).

5) From tail of wind arrow, estimate drift angle (how far off the desired course you must aim the airplane) and from the intersection of wind arrow (heading) and the desired course line, estimate the ground speed. Put ground speed and heading on log (figure 2).

6) From ground speed and distance, compute time in minutes: $\text{Time in minutes} = \frac{\text{distance}}{\text{grnd spd}} \times 60$ Round it off to the nearest minute.

7) Compute fuel required: $F = \frac{(\text{gal/hr})\ (\text{time in min})}{60}$

(figure 1 and figure 2 on next page)

RECOMMENDATIONS

Flight log and polar graph paper for overhead projection: demonstrate problem step by step.

MATERIALS

Polar graph paper, one sheet per student; rulers, compasses, protractors, one per student; one simulated flight log per student

MATERIALS

E 9-J/

SUBJECT Math

CLUSTER Transportation

JOB TITLE Airline Pilot

ACTIVITY Page 2 of 2

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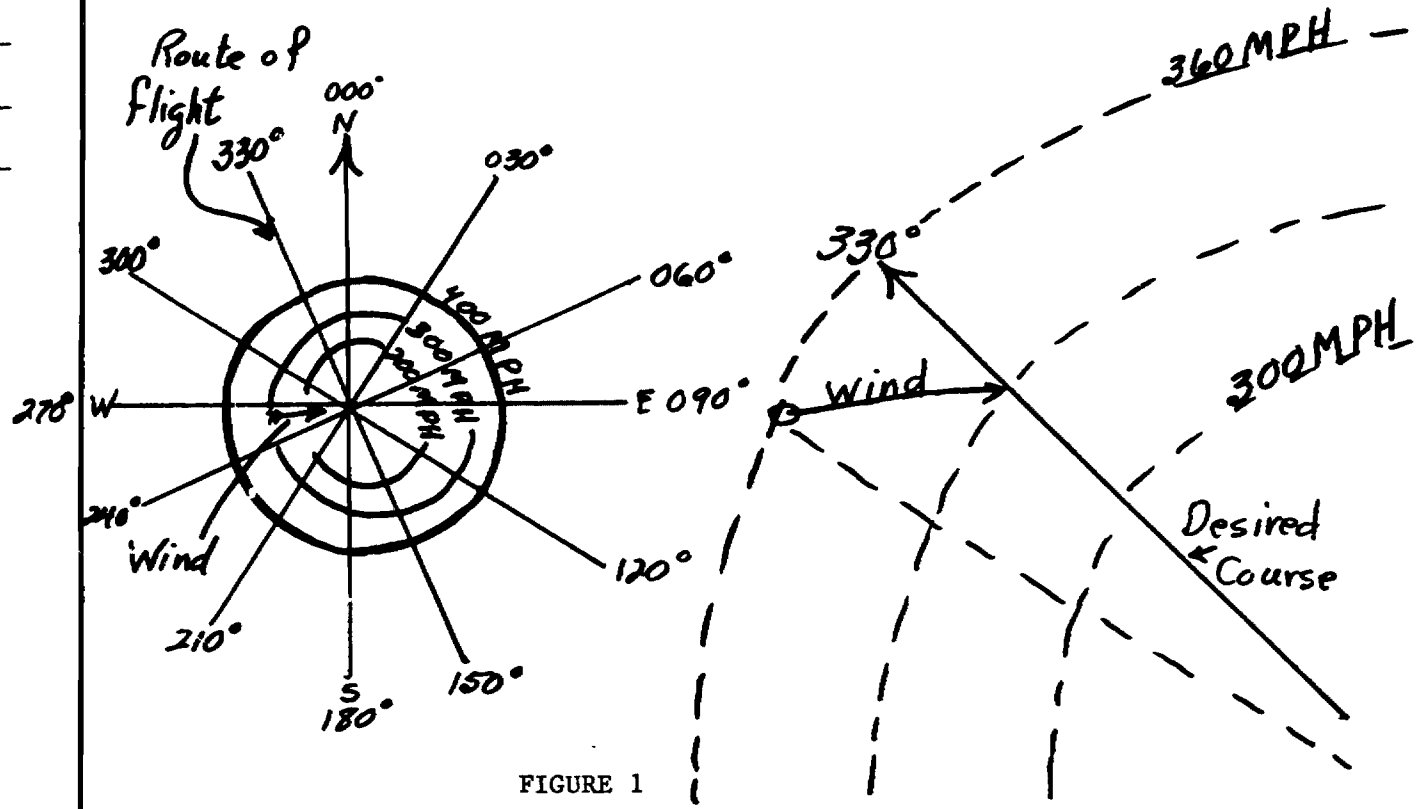


FIGURE 1

Leg	Heading	Distance	Ground Speed	Time	Fuel Required
Boise to _____ Desired course: 330°		150			
_____ to _____ Desired course: 090°		300			
_____ to _____ Desired course: 180°		90			
_____ to _____ Desired course: 270°		360			

FIGURE 2

GRADE 9-J 2

SUBJECT Math

CLUSTER Transportation

JOB TITLE Astronaut
Physicist
Engineer

CONCEPT

Proportions, inverse proportions, powers, functions

PERFORMANCE OBJECTIVE

The student will be able to calculate the value of a given function given values of the variables.

ACTIVITY

I. SITUATION

You are an astronaut planning your next mission in space. The question has come up in the process of manufacturing your spacecraft of how strong will the pull of the earth be when you are out there in space? You know that objects fall toward the earth, even in space, and that the feeling of weightlessness you experienced is because everything about you is falling at the same rate. One of Newton's laws says that the force acting on two bodies is a function of the distance between them. This force of attraction is called gravity and can be expressed by $F = \frac{(k)(m_1)(m_2)}{r^2}$, where f is force, k is a constant, m_1 and m_2 are the masses of the two bodies, and r is the distance between the two bodies.

You, Joe Astronaut, know that on the surface of the earth, F in this equation is 150 pounds for you because that is what you weighed this morning. And you also know that the earth's center of gravity (CG) is about 4,000 miles below at the center of the earth. And you know that your mass, m_1, and the earth's mass, m_2, will stay the same.

II. STEPS

1) Can you estimate how far above the earth's surface you will be if F is 1/2 what i is on the surface? 1/4? 1/9? or any other value?

a) Example: Let Fs = force on surface of earth = 150 pounds
and Fo = force in orbit; and if $\frac{Fo}{Fs} = \frac{1}{2}$ then Fo = 75 pounds.

Call r_s the radius at the surface (distance from CG); then r_s = 4,000 miles.

(Continued)

RECOMMENDATIONS

MATERIALS

GRADE 9-J2

SUBJECT Math

CLUSTER Transportation

JOB TITLE Astronaut
Physicist
Engineer

II. STEPS

1a) Let r_o = radius in orbit; then $\frac{Fo}{Fs} = \frac{\frac{k\ m_1\ m_2}{r_o^2}}{\frac{k\ m_1\ m_2}{r_s^2}} = \frac{r_s^2}{r_o^2}$ but $\frac{Fo}{Fs} = \frac{1}{2}$ and $r_s = 4{,}000$

b) $\frac{1}{2} = \frac{(4{,}000)^2}{r_o^2}$ $\quad r_o^2 = (4{,}000)^2 \times 2$ $\quad r_o = 4{,}000 \times \sqrt{2}$

$r_o = 4{,}000 \times 1.414$ $\quad r_o = 5{,}656$ miles from center of earth.

2) How far is this above the surface? Let D_o = distance above surface = $r_o - r_s$. $D_o = 5{,}656 - 4{,}000 = 1{,}656$ miles. Complete the following table:

$\frac{F_o}{F_s}$	R_o Miles	D_o Miles
$\frac{1}{2}$	5,656	1,656
$\frac{1}{4}$		
$\frac{1}{9}$		

3) Can you see that at any given distance above the surface, you can find the force of gravity on your body?

4) If you could be at the center of the earth, would you be crushed by your own weight? Why or why not? (No)

5) Can you ever get far enough away from earth so that there is no force from earth's gravity? (No)

GRADE 9-J 3

SUBJECT Math

CLUSTER Transportation

JOB TITLE Astronaut

CONCEPT

Square roots, functions, exponents, ratios

PERFORMANCE OBJECTIVE

The student will be able to calculate the value of functions involving ratios and square roots.

RECOMMENDATIONS

ACTIVITY Page 1 of 2

I. SITUATION

You are an astronaut. You know that from Einstein's Theory of Relativity that the mass of an object increases as its velocity increases. The relationship between the object's mass at rest (mo) and its mass in motion (m) is given by the formula $m = \frac{mo}{\sqrt{1-\left(\frac{v}{c}\right)^2}}$ where v is the velocity of the object and c is the speed of light. $C = 3 \times 10^8$ meters per second (approximately 186,000 miles per second).

II. STEPS

1) Find the ratio of velocity to speed of light $\left(\frac{v}{c}\right)$ at which the mass is twice the rest mass.

2) Find the other ratios of $\frac{v}{c}$ and $\frac{m}{mo}$ in the table on the following page.

a) Example: $m = \frac{mo}{\sqrt{1-\left(\frac{v}{c}\right)^2}}$ $\quad m = 2mo = \frac{mo}{\sqrt{1-\left(\frac{v}{c}\right)^2}}$

$$\sqrt{1-\left(\frac{v}{c}\right)^2} = \frac{1}{2} \qquad 1-\left(\frac{v}{c}\right)^2 = \frac{1}{4} \qquad \left(\frac{v}{c}\right)^2 = \frac{3}{4} \qquad \frac{v}{c} = \sqrt{\frac{3}{4}} = \frac{\sqrt{3}}{2}$$

$$v = \frac{1.732 \times 3 \times 10^8}{2} = 2.598 \times 10^8 \text{ m/sec}$$

MATERIALS

MATERIALS

GRADE 9-J3

SUBJECT Math

CLUSTER Transportation

JOB TITLE Astronaut

ACTIVITY

II. STEPS

2)

$\frac{m}{m_0}$	$\frac{v}{c}$	v(m/sec)
2	$\frac{\sqrt{3}}{4}$	2.598×10^8
	.9	
		3×10^7
	0	
		2.85×10^8
4		
		3.0×10^8

GRADE 9-K

SUBJECT Math

CLUSTER Health

JOB TITLE Medical Doctor

CONCEPT

Proportions and functions

PERFORMANCE OBJECTIVE

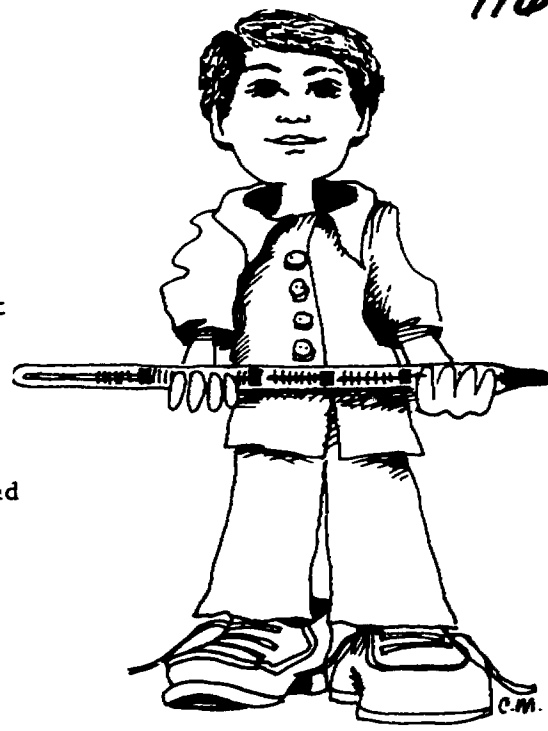
The student will be able to convert from temperature in Fahrenheit to ntigrade, weights from pounds to ..ilograms and compute dosages of medicines.

139

ACTIVITY Page 1 of 2

116

I. SITUATION



You are a doctor in Boise. You have discovered a way to make students three times as smart as their teachers. If you give the students a dose of your wonderful medicine in proportion to their body weights and temperatures in just the right way, they will get straight A's in school. If you goof and give them the wrong amounts, then you find that all their grades go down one letter each. You discover that for each kilogram of body weight and for each degree centigrade of temperature, your patients should take exactly 6 milligrams of your wonderful medicine. The only trouble is, although you got straight A's in math, your assistant dropped out of math in third grade, and you now have to make all the weight and temperature calculations yourself since he gave you the wrong dosage for the Einstein kid who was immediately found to be flunking all his courses at Southwest Junior High School.

II. STEPS

You know that to change temperature from Fahrenheit to centigrade, you use the formula $^{o}C = \frac{5}{9}(^{o}F - 32)$ and to change pounds to kilograms, you use the formula $kg = \frac{\text{pounds}}{2.2}$. On the next page is a list of your patients (and the dose that worked for one of them). Complete the calculations.

RECOMMENDATIONS

MATERIALS

MATERIALS

GRADE 9-K

SUBJECT Math

CLUSTER Health

JOB TITLE Medical Doctor

II. STEPS

Name	Temperature		Weight		Dosage
	°F	°C	lbs	kg	Grams
Audrey	98.6	37	115	52.27	11.6
Bill	99		150		
Charlie	99.4		125		
Doug	98		140		
Emily	98.4		102		
Fran	99		92		
George	100		175		

Example: for Audrey

$^{o}C = \frac{5}{9}(98.6 - 32) = \frac{5}{9}(66.6) = 37^{o}F$

K = 115 ÷ 2.2 = 52.27

Dosage = 37 X 52.27 X 6 = 11 603.94 mg = 11.60394 gm

GRADE 9-K 2

SUBJECT Math

CLUSTER Health Occupations

JOB TITLE Laboratory Technician

CONCEPT

Ratios, percents.

PERFORMANCE OBJECTIVE

The student will be able to calculate and measure the required amounts of medicines and water to obtain a desired quantity of medication.

ACTIVITY

I. SITUATION

You are a pharmacist. You have prescriptions for several doses of two drugs which you must prepare for a patient. It is necessary for the dosage to be exact since the patient's life depends on it. You must give 5 milligrams of "Wonder Drug" and 7 mg of "Miracle Cure" in a 4 ml injection. You have a bottle of each drug. The Wonder Drug is marked 5 mg/ml and the Miracle Cure concentration is 14 mg/ml. You must determine how much of each drug and how much sterile water to mix to get enough medicine in one injection.

II. STEPS

1) You first decide that the patient will probably need 4 doses of the drugs; so you want to mix 5 to be sure to have enough, since you have noticed how Doctor Welby seems to always squirt a little out of the syringe before he gives a shot, wasting a small amount each time the medicine is given.

2) Determine how much medicine is required for 5 doses. (5 X 4 = 20 ml total volume of final mixture.)

3) 5 doses of Wonder Drug requires 5 X 5 mg = 25 mg total.

4) Determine how many ml of Wonder Drug to use. $\left(\frac{25\text{ mg}}{N\text{ ml}} = \frac{5\text{ mg}}{1\text{ ml}}\right)$
Let N = the number of ml of Wonder Drug to use.

5) 5 doses of Miracle Cure requires 5 X 7 mg = 35 mg total.

6) Determine how many ml of Miracle Cure to use. $\left(\frac{35\text{ mg}}{M\text{ ml}} = \frac{14\text{ mg}}{1\text{ ml}}\right)$
Let M = the number of ml of Miracle Cure to use.

7) Add Wonder Drug and Miracle Cure volumes together. How much water is needed to bring the total up to 20 ml?

8) Calculate other dosages using the same concentrations of medicines.

RECOMMENDATIONS

MATERIALS

MATERIALS

9-L'

SUBJECT Math

CLUSTER Public Service

JOB TITLE License Clerk

CONCEPT

Percentage

PERFORMANCE OBJECTIVE

Upon the satisfactory completion of the activity, the student will be able to accurately determine the cost of licensing a boat in the state of Idaho.

142

ACTIVITY

I. SITUATION

You and two of your friends want to determine how much it will cost to license your three boats in the state of Idaho. You know that the minimum license fee is $2.50, but you want to know the exact excise tax on each of your three boats. You own a 1967 16-foot boat with a 100 horsepower engine on it. One of your friends owns a 1969 17-foot boat with a 125 horsepower engine. Your other friend has a 1973 18-foot boat with a 125 horsepower engine.

II. STEPS

1) Multiply the length of the boat times the horsepower times .01%.

2) Multiply the above answer times one of the following:
   a) New to 3 year-old boat-- 0%
   b) 4 to 6 year-old boat-- 15%
   c) 7 to 10 year-old boat-- 30%
   d) 11 to 15 year-old boat-- 40%
   e) 16 years and older boat--50%

3) Subtract the answer to step #2 from that of step #1 to get the total excise tax. Example: a 1959 15-foot boat with a 35 horsepower engine on it.
   a) 15 X 35 X .01% = 5.25
   b) 5.25 X 40% = 2.10
   c) 5.25 - 2.10 = 3.15 ($3.15 is the excise tax paid for one year)

RECOMMENDATIONS

MATERIALS

MATERIALS

GRADE 9-L[2]

SUBJECT Math

CLUSTER Public Service

JOB TITLE Deputy Sheriff

CONCEPT

Sight estimation of weight and height

PERFORMANCE OBJECTIVE

The students will be able to estimate the weight, within a few pounds, and the height, within a couple inches, of people.

ACTIVITY

I. SITUATION

An unknown person steps into the classroom; and upon leaving, the students are asked to describe the person in terms of his/her weight and height.

II. STEPS

1) Arrange for the above situation and then discuss it in class, including why this ability is needed in the field of law enforcement.

2) Have five students line up in front of the class and have their classmates guess the weight of height of each.

RECOMMENDATIONS

MATERIALS

MATERIALS

G 9-M

SUBJECT Math

CLUSTER Agri-Business
Natural Resources

JOB TITLE Wheat Farmer

ACTIVITY

I. SITUATION

A wheat farmer has 2,480 acres in wheat. At the start of the growing season, he expected a yield of 84 bushels per acre; but due to lack of fertilizer (energy crisis), his yield is decreased by 15%. He contracts his wheat for $2.85 a bushel.

CONCEPT

Computation and percentage

II. STEPS

1) Determine the expected yield.

2) Determine the actual yield.

3) Determine the gross profit.

PERFORMANCE OBJECTIVE

The student will determine, by calculations and percentage, the amount of profit a wheat farmer might expect.

RECOMMENDATIONS

MATERIALS

MATERIALS

GRADE 9-N /

SUBJECT Math

CLUSTER Marine Science

JOB TITLE Ship's Navigator

CONCEPT

Analytic geometry

PERFORMANCE OBJECTIVE

The student will be able to plot a simulated Long Range Navigation (LORAN) chart.

145

ACTIVITY Page 1 of 2

I. SITUATION

You are the ship's navigator. You need to have a chart which will explain the principles of LORAN (a Long Range Navigation system which is used throughout the world). LORAN is a system of low frequency radio broadcasts which allows the navigator of ships and aircraft to determine his/her location with a very high level of accuracy. It depends on the navigator's being able to measure the difference in time between the arrival of the radio pulse from two stations in the same LORAN network and checking the difference on a LORAN chart (see figure 1). For any given time difference other than zero, the possible positions of ships with that time difference is a curve called a hyperbola such as the TD = 2 curve or TD = -2 curve.

II. STEPS

1) You can construct a chart like figure 1 by using strips of paper which will represent the time difference of LORAN signals. Plot the stations as in figure 2. Place strips of paper so that the ends meet on the line segment joining and number position 1 on strips next to stations.

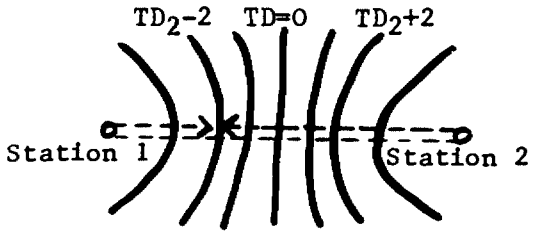


FIGURE 1

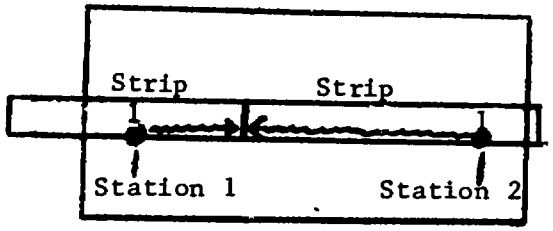


FIGURE 2

Time difference = time of arrival of signal 1 minus time of arrival of signal 2.

TD = 0 on the perpendicular bisector of line connecting stations.

RECOMMENDATIONS

MATERIALS

MATERIALS

GRADE 9-N

SUBJECT Math

CLUSTER Marine Science

JOB TITLE Ship's Navigator

II. STEPS

2) As in figure 3, place strips side by side and mark other numbers at random distances. By placing the paper strips so that both 2's are on the stations and marking where the ends of the strips meet, repeating for 3's, etc.; a set of hyperbolas can be constructed (figure 4). You should construct at least three curves on your chart.

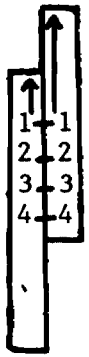


FIGURE 3

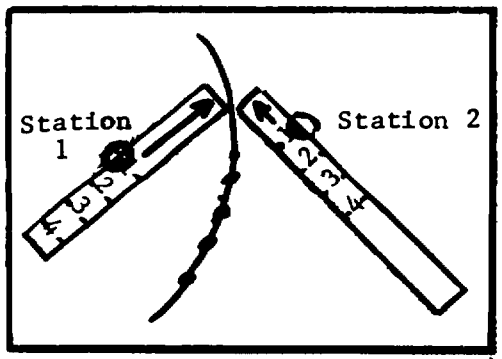


FIGURE 4

3) By seeing where one LORAN position line crosses a second, the ship's location can be determined with extremely high accuracy (figure 5).

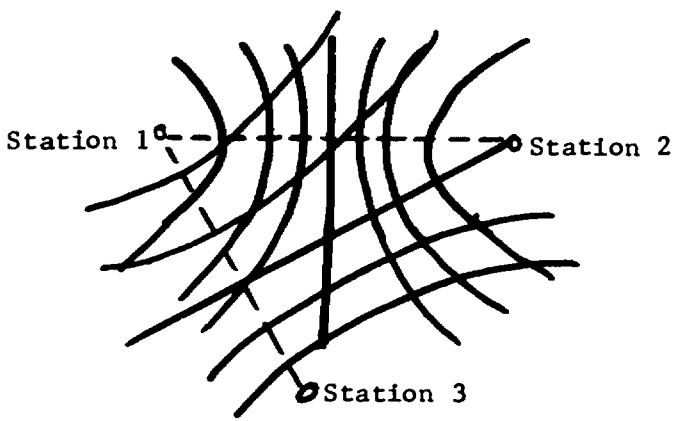


FIGURE 5

GRADE 9-N 2

SUBJECT Math

CLUSTER Marine Science

JOB TITLE Ship's Navigator

CONCEPT

Geometry, time and angle measures

PERFORMANCE OBJECTIVE

The student will be able to calculate the clock time when the sun is highest in the sky given his/her longitude.

ACTIVITY Page 1 of 2

I. SITUATION

You are the navigator of a ship. You know that you can find the ship's latitude if you make a sextant observation of the sun when it is at its highest point in the sky. The sun is highest at noon, if you happen to be on the central meridian of your time zone. If you are east of that meridian, the sun will be at its highest in the sky before noon; if west, then after noon.

II. STEPS

1) Knowing your approximate longitude, you can calculate when the sun should be highest. Figure 1 shows the earth looking toward the south pole from space. The earth is divided into 24 sectors of 15° each. Each 15° sector can be thought of as a time zone. The earth rotates 15° per hour, one complete rotation each 24 hours. So you can see that the sun is at its highest point on some line of longitude at all times. What we want to know is when it will be highest at our position. The reference point for all time and longitude calculations was taken at the Royal Observatory, Greenwich, England. The sun will be over the 0° (prime) meridian at 12:00 noon, Greenwich mean time (GMT), sometimes called "coordinated universal time". It will again cross that meridian 24 hours later. So to find your time of highest sun, called "local apparent noon" (LAN), we just need to work a proportion problem:

$$\frac{\text{Your longitude}}{360^\circ} = \frac{(\text{LAN}-12)}{24 \text{ hours}}$$ where LAN is in hours GMT

(continued)

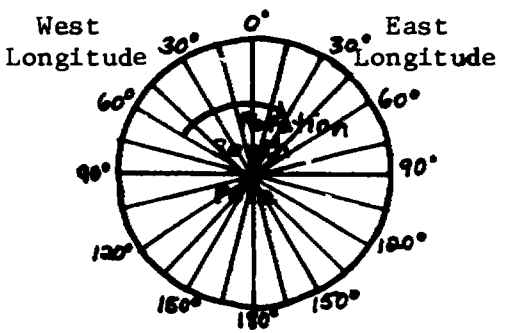


Figure 1

RECOMMENDATIONS

MATERIALS

MATERIALS

GRADE 9-N 2

SUBJECT Math

CLUSTER Marine Science

JOB TITLE Ship's Navigator

II. STEPS

2) For example, the longitude of Chicago is 87° 45'W = 87.75°W. So $\frac{87.75}{360^\circ} = \frac{(LAN-12)(Chicago)}{24}$; LAN (Chicago) = 17.85 hours = 17:51 GMT.

Now to convert to local time: Central DST = GMT-5
LAN CDST = 17:51-5 = 12:51

3) Boise longitude = 115-50W. Calculate Boise LAN. MDST = GMT-6
MST = GMT-7

Answer: LAN (Boise) = 19:43 GMT
= 13:43 MDST = 1:43 p.m. daylight savings time
= 12:43 MST = 12:43 p.m. standard time

GRADE 9th-0'

SUBJECT Math

CLUSTER Marketing

JOB TITLE Retail Clerk

CONCEPT

Addition, Simple percentage, Computation.

PERFORMANCE OBJECTIVE

The student will demonstrate comprehension of addition and simple percentage computation, as measured by the completion of the activity with a minimum of percentage accuracy.

ACTIVITY

I. SITUATION

Student will assume role of sales clerk in local store of his/her choice. Instructor or other student will assume role of customer, and will request assistance of "salesclerk" in completing the sale.

II. STEPS

1) "Salesclerk" will add purchase items on sales slip.

2) "Salesclerk" will compute sales tax of 3% on purchase.

3) "Salesclerk" will total purchase price of all items, add sales tax and finalize total of cost to customer.

RECOMMENDATIONS

MATERIALS

List of prices of items for sale. Sales slips for each student.

MATERIALS

9-02

SUBJECT Math

CLUSTER Marketing

JOB TITLE Salesperson

CONCEPT

Simple percentages

PERFORMANCE OBJECTIVE

The student will demonstrate comprehension of simple percentage computation and application as measured by completion of the accompanying activity with a minimum of 70% accuracy on each step of the activity.

ACTIVITY Page 1 of 2

I. SITUATION

Student is outside salesperson for a major recording firm. The firm is introducing a new brand of record to local retailers. As a promotional tool, the firm has authorized its salespeople to allow each retailer a discount on each case of records. The percentage of this discount will be determined by the number of displays the retailer will set up and maintain on the following schedule: every four displays equals 5% discount, up to a maximum of 20%.

II. STEPS

1) Student "A" will role-play the salesperson. Student "B" or teacher will role-play the retailer.

2) "Salesperson" student will approach "retailer" with full sales approach, including the mention of the display promotion discount.

3) "Retailer" will agree to put up "X" number of displays for "salesperson" and request "Y" number of cases of merchandise.
   a) Note: "X" and "Y" totals will vary for each salesperson.

4) "Salesperson" will compute discount and total purchase price for sale using the following information:
   a) 20 records in a case
   b) case price: $56
   c) 5% discount per four displays

5) Whole class activity: following each transaction, the whole class will compute the following:
   a) Price per record to retailer before discount. (Note: normal record cost is $4.25 without tax.)

RECOMMENDATIONS

MATERIALS

MATERIALS

GRADE 9-0 2

SUBJECT Math

CLUSTER Marketing

JOB TITLE Salesperson

ACTIVITY

II. STEPS

5b) Gross profit per retailer for retailer before discount. (Note: at this point the instructor could introduce such ideas as gross versus net profit and how to figure cost of goods sold, operating expenses, etc.)

c) Price per record to retailer after discount.

d) Gross profit per record for retailer after discount.

e) Total difference (excess profit) for retailer who takes advantage of discount promotion.

9-P/

SUBJECT Math

CLUSTER Construction

JOB TITLE Homeowner

CONCEPT

Volumes, simple algebra

PERFORMANCE OBJECTIVE

Upon the satisfactory completion of the activity the student will be able to accurately compute the volume of a concrete structure and determine the cost of building it.

RECOMMENDATIONS

ACTIVITY

I. SITUATION

A homeowner wishes to build a patio which will be 10 feet wide, 20 feet long and 6 inches deep. He would like to compute the cost of the concrete needed for such a structure.

II. STEPS

1) Compute the volume in cubic yards of concrete needed.

2) How many bags of cement are needed if there are 6 bags to 1 yard of concrete?

3) If the ratio of sand, gravel and cement is 5:10:3, then determine how many yards of sand and gravel are needed.

4) Determine the cost of cement, the cost of sand and the cost of gravel if 1 bag of cement is $2.15, sand is $2/yard and gravel is $2/yard.

5) Determine the total cost of concrete.

MATERIALS

GRADE 9-P 2

SUBJECT Math

CLUSTER Construction

JOB TITLE Architect
Designer
Planner
Civil Engineer

CONCEPT

Area, volume, scale drawing

PERFORMANCE OBJECTIVE

The student will be able to compute volumes and prepare scale drawings including estimations.

RECOMMENDATIONS

ACTIVITY

I. SITUATION

You are an architect working on a modern home for the richest man in town. He wants a concrete patio with some unusual features. He wants flower beds, a shade tree, and a fish pond in the shape shown in figure 1. You decide that with a good scale drawing, some good calculations and maybe an educated guess or two, you can come up with a good estimate of how much concrete the job will require. Concrete costs $22 per cubic yard plus $10 delivery charge if you buy less than 5 yards. You decide to use a 6" thick slab of concrete.

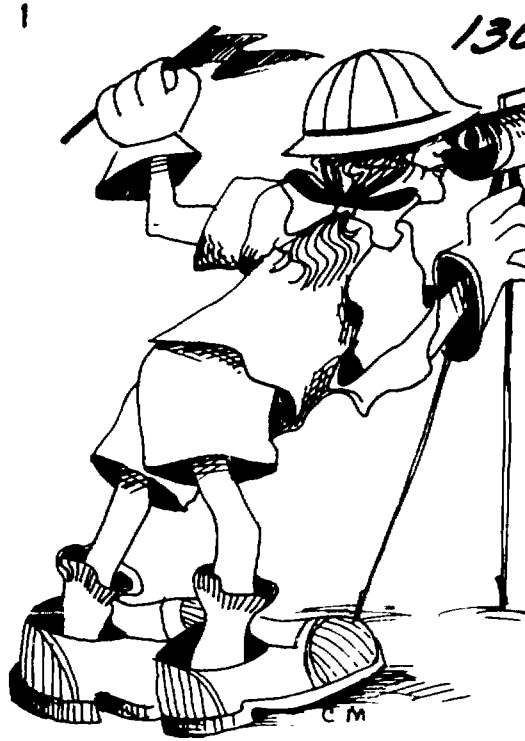
II. STEPS

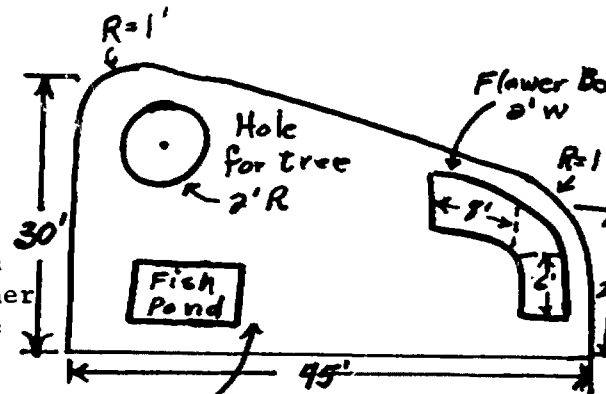
1) Prepare scale drawing and 1' X 1' overlay grid. (Suggestion: ¼" = 1' scale)

2) With curved corners and flower beds, compute the area of the patio minus cutout areas for tree, fish pond and flower bed. You may want to guess at areas to be deducted in curves of the flower bed rather than computing them. If so, a large-scale detail drawing and finer grid is recommended so you can guess more accurately. Compute volume of material by multiplying area by thickness.

3) Compute volume of material to construct a fish pond. You must consider thickness of walls. A good detailed drawing is a must. Label all dimensions carefully.

4) Convert volume in cubic feet to cubic yards and determine cost. You must buy the next higher whole yard of concrete. You should also get the current cost of concrete.





MATERIALS

MATERIALS