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ABSTRACT

This module is the third in a series of 12 learning modules designed to teach occupational mathematics. Blocks of informative material and rules are followed by examples and practice problems. The solutions to the practice problems are found at the end of the module. Specific topics covered include calculator addition, adding measurements of different levels of precision, and word problems. (YLB)

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MODULE 3--CALCULATOR ADDITION AND APPLICATIONS

Addition is one of the four basic operations of mathematics. Addition is the operation to use when a person needs to find the combined values of two or more numbers. The result of addition is called the total or sum.

The key sequence to complete an addition on a calculator is shown below. The illustration includes:

a) directions for each step,
b) keys used, and
c) calculator display at the conclusion of each step.

Example 1: Use a calculator to compute the following sum:

Add 8.25
0.79
2.836

Solution: Calculator steps for Example 1.

Directions	Key Strokes	Display
enter 8.25	[8] [.] [2] [5]	8.25
add	[+]	8.25
enter 0.79	[.] [7] [9]	0.79
add	[+]	9.04
enter 2.836	[2] [.] [8] [3] [6]	2.836
end problem	[=]	11.876

The solution to 8.25 + 0.79 + 2.836 is 11.876

Example 2: Verify the following total using a calculator:

Add 180.5
29.79
63.4
30.47
304.16

Solution: Calculator step for Example 2

Solution: Calculator step for Example 2

Directions		Key Strokes	Display
enter 180.5		[1] [8] [0] [.] [5]	180.5
add	[+]		180.5
enter 29.79		[2] [9] [.] [7] [9]	29.79
add	[+]		210.29
enter 63.4		[6] [3] [.] [4]	63.4
add	[+]		273.69
enter 30.47		[3] [0] [.] [4] [7]	30.47
end problem	[=]		304.16

Example 3: Fill in the display values which are shown on a calculator as the addition is input into the calculator.

```
Add:     79.138
          2.06
          7.903
         46.31
        -------
        135.411
```

Solution:

Directions		Key Strokes	Display
enter 79.138		[7] [9] [.] [1] [3] [8]	______
add	[+]		______
enter 2.06		[2] [.] [0] [6]	______
add	[+]		______
enter 7.903		[7] [.] [9] [0] [3]	______
add	[+]		______
enter 46.31		[4] [6] [.] [3] [1]	______
end problem	[=]		______

There are three ways to train a calculator so it will give the right answer time after time; 1) practice, 2) practice, 3) practice. A calculator is only as accurate as its operator.

<u>PRACTICE PROBLEMS:</u> Use a calculator to find the sums in these addition problems.

1.
137.64
4.7
0.0004
170.027
____

2.
7.14
19.45
8.5
20.71
____

3.
0.008
120.015
147.49
6.3
____

4.
6.1
63
7.31
20.71
____

5.
127.11
72.4
49.41
80.18
____

6.
48.143
159
64.718
180.14
____

7.
63.908
3.12
4.47
16.010
____

8.
0.37
4.5
0.003
1.060
____

9.
15.412
140
21.30
9.009
____

10.
0.0056
0.023
0.00456
0.9005
____

When measurements of different precision are to be added, the result should not be of greater precision than the least precise of the measurements. Consider needing to know the perimeter of a triangular shaped piece. The first side is measured with an English ruler as 6.3 in., the second side with an English caliper as 3.78 in., and the third side with an English micrometer as 4.0835 in.

Because the perimeter of a triangle is the sum of its three side lengths, the perimeter calculation is the addition

first side	= 6.3	in.
second side	= 3.78	in.
third side	= 4.0835	in.
perimeter	= 14.1635	in.

The computed value of the perimeter, 14.1635 in., has its last digit 5 in the ten-thousandths place. Considering the different instruments used to obtain the measurements, is it possible to claim to know the perimeter correct to a precision of

0.0001 in.? The correct reply is a very loud NO! When measurements of different precision are to be added, the result should not be of greater precision than the least precise of the measurements.

The American Society for Testing and Materials recommends and uses the procedure below for adding (and subtracting) measurements which have different levels of precision.

MEASUREMENT ADDITION RULE

To add measurements of different precision

1. Make certain that all measurements are in the same measurement unit. For example; all are inches or that all are in millimeters.

2. Identify the measurement which has the least precision.

3. Use rounding off, as needed, so each measurement has the same precision as the least precise measurement. When measurements of the same precision are arranged into a column addition form, then each measurement will end in the same digit column.

4. Now add the numbers and attach their common unit of measure. When two or more measurements with the same unit of measure are added, then the s ., has the common unit of measure. For example, inches plus inches is inches.

Example 4: Add the three side lengths of 6.3 in., 3.78 in., and 4.0835 in. to obtain the perimeter of a triangle.

Solution: All lengths have the same unit of measure, inch. Look at the measurements in column addition form:

```
 6.3    in.
 3.78   in.
 4.0835 in.
```

The measurements are not of the same precision. The least precise measurement is the 6.3 in. with a precision of 0.1 in. The other two measurements must be rounded to the nearest 0.1 in.

```
 6.3 in.
 3.8 in.
 4.1 in.
14.2 in.
```

Note: After rounding, all measurements end in the same digit column

A perimeter of 14.2 i ch is as precise a result as possible.

Example 5: Add the following measurements:

16.7247 mm + 31.074 mm + 9.34 mm

Solution: All are in the same unit of measure, mm.

```
  16.7247 mm          Note: Measurements do not end in
  31.074  mm                the same digit column.
   9.34   mm  <-------------Measurement of least
                            precision, 0.01 mm.
```

Rounding to nearest 0.01 mm is necessary so all measurements have the same precision.

```
  16.72  mm
  31.07  mm
   9.34  mm
  -----
  57.13  mm
```

The sum is 57.13 mm, with the correct precision.

PRACTICE PROBLEMS: Use the Measurement Addition Rule to compute the following sums of measurements.

```
11.  168   in.          12.  42.6    mm
      34.7 in.               16.41   mm
      61   in.                1.417  mm
                             34.4    mm

13.  120.5   mm         14.  10.555 in.
      16.4   mm               9.5   in.
       1.417 mm              13.75  in.
       9.03  mm

15.   29.95  mm         16.   407     mm
       1.853 mm              1648.5   mm
     140.2   mm                32.74  mm
      13.81  mm                98.1   mm
```

The real world presents its problems in a form which is more descriptive than as columns to add. When these problems deal with job related situations, then such problems are called application problems. To communicate ideas about these job situations between people requires a combination of the English language and the language of mathematics. The written or spoken description of problem situations which require that mathematics be used to summarize or solve, are called word problems.

Word problems give a student the chance to put their understanding and skill in mathematics to practical use. The difficulty with word problems is that how the number values are to be used together depends upon the situation. Word problems are not solved by always adding or always subtracting or always anything. A person learns through experience that certain situations require the total of several values so addition is needed.

While working through the next few examples and the practice problems which follow, remember this purpose statement.

The purpose of these word problems is to become exposed to situations which are solved by addition.

A study of these problems will allow a student to learn WHEN to add, not how to add. After completion of an example or practice problem, tell yourself that "this was a problem situation WHEN addition was used."

A plan of attack needs to be developed which can be used on word problems. Some general guidelines which may be helpful and which will be followed in the lesson examples include the steps:

1) Read a written problem slowly and carefully. Re-read until the situation is clearly understood. Listen carefully to a spoken problem. Ask for parts of the description to be repeated until the situation is clearly understand.

2) Identify the name of the amount to be computed. Say "I need to compute the________________."

3) Sort the number information which is important from the unimportant values. When possible use some kind of visual aid with which to organize important values. This might include drawing a picture or making a table of values.

4) Look for clues which tell WHEN a particular operation is the one to use. Recall previous problems which were similar and how they were solved.

5) Calculate the solution.

6) Check the answer. Is the amount reasonable? Has the question that was asked been answered?

Example 6: At the beginning of Monday's shift the shop foreman hands an employee 3 work orders and says these need to be ready for shipment by the end of the day. Order #8127 is for 3,800 rivets, order #8164 is for 675 rivets and order #8199 is for 1,240 rivets. How many rivets need to be produced on Monday?

Solution steps:

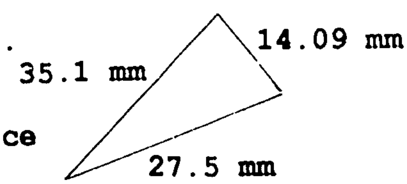
1) Read example 6 as many times as necessary.
2) Monday's production needs to be computed.
3) Important information can be organized into a table:

Work Order	Production
8127	3,800
8164	675
8199	1,240

4) Monday's production means total. That is WHEN addition is used.
5) 3800 + 675 + 1240 = 5715
6) 5,715 rivets is the answer to the question.

Example 7: Find the perimeter of a triangle that has sides of 35.1 mm, 27.5 mm and 14.09 mm.

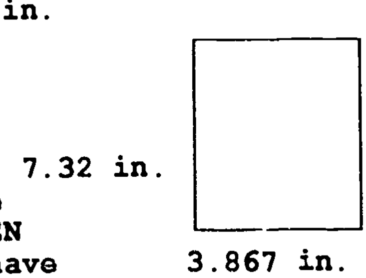
Solution steps



1) The perimeter P must be found.
2) Information can be organized with a picture.
3) Perimeter is the total distance around an object. Total is WHEN addition is used.
   Measurements must be of the same precision before addition.
   Round 14.09 mm ≈ 14.1 mm.
4) P = 35.1 mm + 27.5 mm + 14.1 mm
   = 76.7 mm
5) The perimeter is 76.7 mm.

Example 8: Find the perimeter of a rectangle which has a length of 7.32 in. and a width of 3.867 in.

Solution steps:

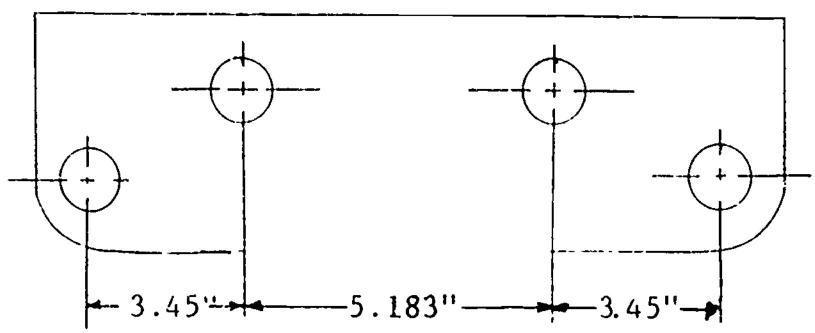


1) The perimeter P must be found.
2) Information can be organized with a picture.
3) Perimeter is the total distance around an object. Total is WHEN addition is used. Rectangles have 4 sides. Measurements must be of the same precision before adding.
   Round 3.867 in. ≈ 3.87 in.
4) P = 7.32 in. + 3.87 in. + 7.32 in. + 3.87 in.
   = 22.38 in.
5) The perimeter is 22.38 in.

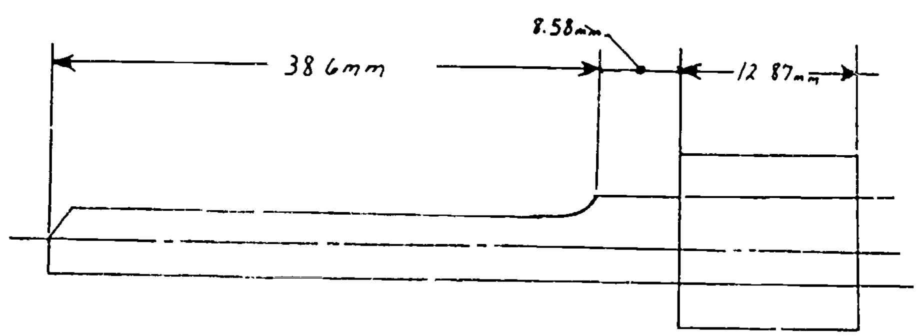
PRACTICE PROBLEMS: Solve the following problem situations.

17. Standard thread 9/16"x 2 1/2" bolts are used at 3 different stations along the assembly line. Inventory shows that #2 station has 4,812, #6 station has 1,087 and #14 station has 3,748 of this bolt. How many 9/16" x 2 1/2" bolts are on hand?

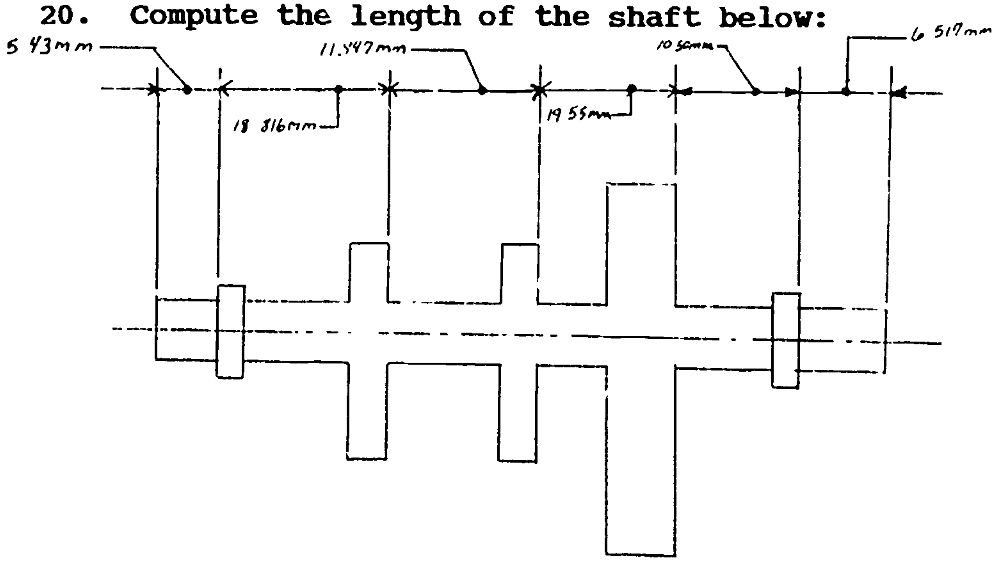
18. Find the distance between the centers of the two end-holes of the plate below.



19. Compute the overall length of the tool below:



20. Compute the length of the shaft below:



21. Find the perimeter of a triangle whose three sides have lengths of 8.07 mm, 10.9 mm, and 15.317 mm.

22. Compute the perimeter of a triangle whose three sides have lengths of 7.823 in., 3.66 in., and 5.7 in.

23. Calc late the distance around a rectangle with a length of 13.85 in. and a width of 6.9 in.

24. Find the perimeter of a 9.87 cm long and 5.613 cm wide rectangle.

25. Five pieces of metal are clamped together. Their thicknesses are 2.38 mm, 10.5 mm, 3.50 mm, 1.425 mm and 8.275 mm. What is the total thickness of the the five pieces.

Solutions to practice problems -- Module 3.

1. 312.674	2. 55.8	3. 273.813
4. 97.12	5. 329.1	6. 452.001
7. 87.508	8. 5.933	9. 186.721
10 0.93366	11. 264 in.	12. 94.8 mm
13. 147.3 mm	14. 33.9 in.	15. 185.9 mm
16. 2187 mm	17. 9647	18. 12.08 in.
19. 60.1 mm	20. 72.77 mm	21. 34.3 mm
22. 17.2 mm	23. 41.6 in.	24. 30.96 cm
25. 26.1 mm		

END

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