DOCUMENT RESUME

ED 327 705 CE 056 767

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TITLE Calculator Division Fraction to Decimal Conversion Applications of Division. Fundamentals of Occupational Mathematics. Module 6.
INSTITUTION Central Community Coll., Grand Island, NE.
SPONS AGENCY Office of Vocational and Adult Education (ED), Washington, DC.
PUB DATE 90
CONTRACT V199A90067
NOTE 15p.; For related modules, see CE 056 762-773.
PUB TYPE Guides - Classroom Use - Materials (For Learner) (051)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Arithmetic; *Calculators; Community Colleges; *Decimal Fractions; *Division; Individualized Instruction; Learning Modules; Mathematical Applications; *Mathematics Instruction; Measurement; Number Concepts; Numbers; Pacing; Two Year Colleges; Vocational Education; *Word Problems (Mathematics)
IDENTIFIERS *Job Related Mathematics

ABSTRACT

This module is the sixth 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 division, mixed number fractions, division of measurements, fraction to decimal conversion, rules of accuracy, and word problems. (YLB)

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**EXAMPLE 1:** Calculate 473.9 ÷ 18.7 and round the quotient to the nearest hundredth.

**Solution:** Calculator steps for division are shown below.

| Directions | Key strokes | Display |
|---|---|---|
| Enter dividend | 4 7 3 . 9 | 473.9 |
| Divide | ÷ | 473.9 |
| Enter divisor | 1 8 . 7 | 18.7 |
| End division | = | 25.34224599 |

Quotient to nearest hundredth is 25.34

**EXAMPLE 2:** Calculate 31.87 ÷ 86.3 and round the quotient to four significant digits.

**Solution:**

| Directions | Key Strokes | Display |
|---|---|---|
| Enter dividend | 3 1 . 8 7 | 31.87 |
| Divide | ÷ | 31.87 |
| Enter divisor | 8 6 . 3 | 86.3 |
| End divide | = | 0.369293163 |

Quotient to 4 digit accuracy is 0.3693

**EXAMPLE 3:** Compute $\frac{217.95}{70.2}$ accurate to three significant digits.

**Solution:**

$\frac{217.95}{70.2}$ is the same as 217.95 ÷ 70.2

| Directions | Key Strokes | Display |
|---|---|---|
| Enter dividend | 2 1 7 . 9 5 | 217.95 |
| Divide | ÷ | 217.95 |
| Enter divisor | 7 0 . 2 | 70.2 |
| End division | = | 3.104700855 |

The quotient in 3 digit accuracy is 3.10

**PRACTICE PROBLEMS:** Calculate the following quotients and round the result to three digit accuracy.

1. 28.36 ÷ 4.07
2. $\frac{27.2}{0.084}$
3. 0 075 ÷ 6.1
4. $\frac{7.924}{187.3}$
5. 0.0865 ÷ 0.192
6. $\frac{79.5}{0.026}$
7. 723.9 ÷ 48.3
8. $\frac{609}{265.3}$

Calculate the following quotients and round the result to the nearest thousandth.

9. $\frac{7.82}{4.06}$
10. $\frac{2.917}{3.86}$
11. $\frac{0.175}{3.47}$
12. 287.4 ÷ 90.9
13. 0.429 ÷ 62.5
14. 1.648 ÷ 23.6

Division is the operation which changes the common fractions into an equal decimal amount. Simple fractions written as m/n are changed into their decimal equivalent using m ÷ n.

**EXAMPLE 4:** Change the following simple fractions into decimals.

(a) $\frac{7}{16}$ =

(b) $\frac{9}{32}$ =

(c) $\frac{23}{8}$ =

**Solution:**

(a) $\frac{7}{16} = 7 \div 16 = 0.4375$

(b) $\frac{9}{32} = 9 \div 32 = 0.28125$

(c) $\frac{23}{8} = 23 \div 8 = 2.875$

Mixed number fractions are a combination of a whole number and a simple fraction. For instance, 3 5/8 is the addition of whole number 3 and simple fraction 5/8. That is, 3 5/8 = 3 + 5/8 = 5/8 + 3. To calculate the decimal value of a mixed number fraction, change the fraction part to a decimal and add the whole number.

**EXAMPLE 5:** Change the following mixed number fractions into a decimal.

(a) 3 5/8

(b) 7 11/16

**Solution:**

(a) 3 5/8 = 3 + 5/8 = 5/8 + 3
= 5 ÷ 8 + 3
= 0.625 + 3
= 3.625

(b) 7 11/16 = 7 + 11/16 = 11/16 + 7
= 11 ÷ 16 + 7
= 0.6875 + 7
= 7.6875

**PRACTICE PROBLEMS:** Change the given fractions and mixed fractions into an equivalent decimal.

| | |
|---|---|
| 15. 3/8 | 16. 13/16 |
| 17. 17/32 | 18. 1 19/64 |
| 19. 3 1/16 | 20. 2 1/4 |
| 21. 4 3/16 | 22. 3 9/32 |
| 23. 5 5/64 | 24. 1 7/32 |

When the two numbers involved in a division operation are both measurements, then the operation plays a major role in determining both the resulting unit of measure and the number value The next examples are selected to support general statements about the final unit of measure when the units for the divisor and dividend are similar in some unit.

**EXAMPLE 6:** Into how many 9 in. pieces can a 144 in. bar be cut?

**Solution:**

$$144 \text{ in.} \div 9 \text{ in.} = (144 \div 9)\ (\text{in.} \div \text{in.})$$
$$= 16$$

**EXAMPLE 7:** How many 12 mm pieces can be cut from a 120 mm long band of steel?

**Solution:**

$$120 \text{ mm} \div 12 \text{ mm} = (120 \div 14)(\text{mm} \div \text{mm})$$
$$= 8.571$$
$$\approx 8$$

**EXAMPLE 8:** How many rectangles with a 16 $in^2$ area can be cut from a sheet whose area is 1152 $in^2$?

**Solution:**

$$1152\ in^2 \div 16\ in^2 = (1152 \div 16)(in^2 \div in^2)$$
$$= 72$$

The problems in Examples 6, 7 and 8 had exactly the same unit of measure in both divisor and dividend. Their answers had no unit of measure.

**RULE:** When two measurements which have exactly the same unit of measure are divided, the units of measure cancel each other and the quotient has no unit of measure.

**EXAMPLE 9:** How wide is the rectangle whose area is 48 $in^2$ and length is 12 in.?

**Solution:** We need the missing factor of "12 in. times what is 48 $in^2$."

$$\begin{aligned} \text{width} &= 48\ in^2 \div 12\ in \\ &= (48 \div 12)(in^2 \div in) \\ &= 4\ in \end{aligned}$$

Note that $in^2 \div in = in$.

**EXAMPLE 10:** How big is the top of a rectangular block with a volume of 240 $mm^3$ and a height of 15 mm?

**Solution:** We need to find the missing factor in, "What is 15 mm multiplied by to make 240 $mm^3$?"

$$\begin{aligned} \text{top} &= (240 \div 15)(mm^3 \div mm) \\ &= 16\ mm^2 \end{aligned}$$

Note that $mm^3 \div mm = mm^2$.

**RULE:** When dividing measurements where the dividend unit of measure and the divisor unit of measure have some common unit, then the quotient will have the unit of measure remaining after cancelling that common unit.

Consider some examples where the dividend and divisor have no common unit of measure.

**EXAMPLE 11:** How fast is an axle turning if it makes 9000 revolutions during a 6 minute time interval?

**Solution:**

$$\begin{aligned} \text{speed} &= (9000\ \text{revolutions}) \div (6\ \text{minutes}) \\ &= (9000 \div 6)\ (\text{revolutions} \div \text{minutes}) \\ &= 1500\ \text{revolutions per minute} \\ &= 1500\ \text{rpm} \end{aligned}$$

**EXAMPLE 12:** What is the production rate of an employee who produces 424 parts in an 8 hour day?

**Solution:**

$$\begin{aligned} \text{production rate} &= (424\ \text{parts}) \div (8\ \text{hour}) \\ &= (424 \div 8)\ (\text{parts} \div \text{hr.}) \\ &= 53\ \text{parts per hour} \end{aligned}$$

**RULE:** When dividing measurements where the dividend unit of measure and divisor unit of measure have nothing common about their units, then the quotient will have the unit of measure named as dividend unit PER divisor unit.

Other examples in which the units of measure do not cancel include problems resulting in units like miles per hour, feet per second, dollars per hour, pounds per cubic foot and inches per

revolution.

**PRACTICE PROBLEMS:** Determine the quotient and final unit of measure, if any, for the division problems.

25. 336 mm ÷ 16 mm
26. 153 in. ÷ 9 in.
27. 1320 mm ÷ 24 mm
28. 192 $in^2$ ÷ 16 in.
29. 6180 $mm^2$ ÷ 60 mm
30. 4250 $mm^3$ ÷ 250 $mm^2$
31. 2520 $in^3$ ÷ 35 in.
32. 2250 revolutions ÷ 3 minutes
33. \$224 ÷ 40 hours
34. 7920 feet ÷ 90 seconds
35. 914.4 mm ÷ 36 in.
36. 468 pounds ÷ 18 $in^2$

The accuracy of the number which results from a division of measurements must reflect the accuracy of the instruments used in making the measurements. The rule to follow when measurements are used in division is essentially identical to the steps of the rule of accuracy when multiplying.

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RULES OF ACCURACY FOR DIVISION OF MEASUREMENTS

To divide measurements:

1) First, divide the measurements as given.

2) Round the final quotient to the same number of significant digits as the measurement which has the least number of significant digits.

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**EXAMPLE 13:** Apply the rule of division of measurements and the rules of units of measure in computing the quotients.

(a) 28,800 $ft^3$ ÷ 216 ft

(b) 279.5 lb ÷ 2.84 $ft^3$

**Solution:**

(a) Both 28,800 and 216 are 3 digit accurate measurements.

$28{,}800\ ft^3 \div 216\ ft = (28{,}800 \div 216)(ft^3 \div ft)$
$= 133.3333333\ ft^2$
$\approx 133\ ft^2$

(b) The least accurate measurement is the 2.84 $ft^3$: 3 digit.

$279.5\ lb \div 2.84\ ft^3 = (279.5 \div 2.84)(lb \div ft^3)$
$= 98.41549296\ lb\ per\ ft^3$
$\approx 98.4\ lb\ per\ ft^3$

While working through the next few examples and the practice problems which follow, remember what students are trying to learn. The purpose of word problems is to become experienced in situations which require division. A student needs to learn WHEN to divide. After completion of a problem, review the information which described WHEN a particular operation was the one to be used.

Some situations which suggest that the division m÷n is the operation to use are:

1) How many times is n contained in m?
2) n multiplied by what makes m?
3) The answer is to be expressed in m's unit per n's unit.

**EXAMPLE 14:** How many pieces of length 36.0 mm can be cut from an angle iron that is 186.4 mm long? How long is the piece of scrap that is left?

**Solution:** First, compute how many 36's are contained in 186.4. Best operation is division:
186.4 ÷ 36 = q.
Next, find the length of the scrap.

| Directions | Key Strokes | Display |
|---|---|---|
| Enter 186.4 | 1 8 6 . 4 | 186.4 |
| Divide | ÷ | 186.4 |
| Enter 36.0 | 3 6 | 36. |
| End divide | = | 5.177777778 |

The answer to the first question is 5 pieces.

The next steps calculate the scrap length by formula
(q - its whole number) (divisor)

| | | |
|---|---|---|
| Leave last display | | 5.177777778 |
| Subtract | [-] | 5.177777778 |
| Enter 5 | [5] | 5. |
| End subtract | [=] | 0.1777777778 |
| Multiply | [x] | 0.1777777778 |
| Enter divisor 36 | [3] [6] | 36. |
| End problem | [=] | 6.4 |

Scrap piece is 6.4 mm long.

**EXAMPLE 15:** How many pieces 7.25" long can be cut from angle stock that is 120" long? How long is the piece of scrap that is left?

**Solution:** The number of pieces is the whole number portion of 120 ÷ 7.25

| Directions | Key Strokes | Display |
|---|---|---|
| Enter 120 | [1] [2] [0] | 120. |
| Divide | [÷] | 120. |
| Enter 7.25 | [7] [.] [2] [5] | 7.25 |
| End divide | [=] | 16.55172414 |

The first solution is 16 pieces.

The scrap piece has length of (decimal part)·(divisor)

| | | |
|---|---|---|
| Leave last display | | 16.55172414 |
| Subtract | [-] | 16.55172414 |
| Enter whole number | [1] [6] | 16. |
| End subtract | [=] | 0.551724137 |
| Multiply | [x] | 0.551724137 |
| Enter divisor | [7] [.] [2] [5] | 7.25 |
| End problem | [=] | 4 |

Scrap piece is 4 in. long.

**EXAMPLE 16:** What is the gasoline consumption in miles per gallon of an automobile which uses 16.7 gallons of gas to go 429.6 miles?

**Solution:** To compute miles per gallon is WHEN to divide. Miles per gallon means miles ÷ gallons. Gallons of gas was measured to 3 digit accuracy.

Consumption = 429.6 miles ÷ 16.7 gal.
= (429.6 ÷ 16.7) (mi. ÷ gal)
= 25.7245509 mpg
≈ 25.7 mpg

**PRACTICE PROBLEMS:** Use the rules of division of measurements to evaluate

37. 360 $ft^2$ ÷ 12 ft
38. 9180 $yd^3$ ÷ 36 $yd^2$
39. 62,500 $in^3$ ÷ 25 in.
40. 1520 $m^3$ ÷ 40 m
41. 4800 volts ÷ 14.2 amps
42. 288,000 $ft^3$ ÷ 216 ft

Solve the following application word problems. Follow the rule of accuracy in expressing the number value of your solution. Include the correct unit of measure.

43. A 78 foot cable is to be cut into 3.25 foot lengths. Into how many lengths can the cable be cut?

44. How many metal sheets are in a stack that measures 18 inches high if each sheet is 0.0060 in. thick?

45. A shop foreman may spend $335 to use as overtime to complete a job. Overtime pay is $16.75 per hour. How many hours of overtime may he use?

46. The cutting tool on a lathe moves 3/128 in. along the piece, being turned for each revolution of work. How many revolutions will it take to turn a length of 9 9/64 in. stock in one operation?

47. How many lengths of wire each 3 3/4 in. long, can be cut from a 250 in. roll?

48. Two metal strips are riveted together in a straight line, with 6 equally spaced rivets. The distance between the first and last rivet is 28 1/8 in. What is the distance between any two consecutive rivets?
Caution: Count spaces, not rivets.

49. A total of 19 holes are to be equally spaced in a straight line between two points. The first .and last hole are to have their centers 130.5 mm apart. . How far apart will the centers of two consecutive holes be?
Caution: Count spaces, not holes.

50. A steel rod 32.63 in. long is to be cut into 3.56 in. long pieces. Each cut wastes 0.15 in. of rod in shavings.
(a) How many pieces can be cut and
(b) how many inches of rod are left as waste?

**SOLUTIONS TO PRACTICE PROBLEMS--Module 6**

| | | | | | |
|---|---|---|---|---|---|
| 1. | 6.97 | 2. | 324 | 3. | 0.0123 |
| 4. | 0.0423 | 5. | 0.451 | 6. | 3060 |
| 7. | 15.0 | 8. | 2.30 | 9. | 1.926 |
| 10. | 0.756 | 11. | 0.050 | 12. | 3.162 |
| 13. | 0.007 | 14. | 0.070 | 15. | 0.375 |
| 16. | 0.8125 | 17. | 1.21875 | 18. | 1.296875 |
| 19. | 3.125 | 20. | 2.25 | 21. | 4.1875 |
| 22. | 3.28125 | 23. | 5.078125 | 24. | 1.21875 |
| 25. | 21 | 26. | 17 | 27. | 55 |
| 28. | 12 in. | 29. | 103 mm | 30. | 17 mm |
| 31. | 72 $in^2$ | 32. | 750 revolutions per minute | | |
| 33. | $5.60 per hr | 34. | 88 ft per second | | |
| 35. | 25 mm per in. | 36. | 26 lbs per $in^2$ | 37. | 30 ft |
| 38. | 260 yd | 39. | 2500 $in^2$ | 40. | 40 m |
| 41. | 340 volts per amp | | | 42. | 1330 $ft^2$ |
| 43. | 24 | 44. | 3000 | 45. | 20 hours |
| 46. | 390 revolutions | | | 47. | 66 |
| 48. | 5.625 in. | 49. | 7.25 mm | 50. | (a) 8<br>(b) 2.95 in. |

# END

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## Date Filmed
## July 17, 1991