

# Lesson 13



## Negative Exponents as Fractions

A number with a negative exponent represents a fraction or decimal. The numerator is 1 and the denominator is the same base but with a positive exponent. Notice the patterns in these examples.

$$2^4 = 2 \times 2 \times 2 \times 2 = 16$$

$$10^4 = 10 \times 10 \times 10 \times 10 = 10,000$$

$$2^3 = 2 \times 2 \times 2 = 8$$

$$10^3 = 10 \times 10 \times 10 = 1,000$$

$$2^2 = 2 \times 2 = 4$$

$$10^2 = 10 \times 10 = 100$$

$$2^1 = 2$$

$$10^1 = 10$$

$$2^0 = 1$$

$$10^0 = 1$$

$$2^{-1} = \frac{1}{2^1} = \frac{1}{2}$$

$$10^{-1} = \frac{1}{10^1} = \frac{1}{10}$$

$$2^{-2} = \frac{1}{2^2} = \frac{1}{2 \times 2} = \frac{1}{4}$$

$$10^{-2} = \frac{1}{10^2} = \frac{1}{10 \times 10} = \frac{1}{100}$$

$$2^{-3} = \frac{1}{2^3} = \frac{1}{2 \times 2 \times 2} = \frac{1}{8}$$

$$10^{-3} = \frac{1}{10^3} = \frac{1}{10 \times 10 \times 10} = \frac{1}{1,000}$$

$$2^{-4} = \frac{1}{2^4} = \frac{1}{2 \times 2 \times 2 \times 2} = \frac{1}{16}$$

$$10^{-4} = \frac{1}{10^4} = \frac{1}{10 \times 10 \times 10 \times 10} = \frac{1}{10,000}$$

What patterns can you see?

Do you see that with powers of two, each number is two times the number below it even when we move into negative exponents? Did you notice that with powers of ten, each number is ten times the number below it?

Notice that  $2^4$  is 16, but  $2^{-4}$  is  $\frac{1}{16}$ . Notice that same type of pattern for each positive exponent and its opposite negative exponent.

**Write the products first with an exponent in the denominator, then as a common fraction. The first one shows you how.**

1. a.  $3^{-3} = \frac{1}{3^3} = \frac{1}{27}$

b.  $2^{-5} = \frac{1}{2^5} = \frac{1}{32}$

c.  $10^{-2} = \frac{1}{10^2} = \frac{1}{100}$

2. a.  $7^{-2} = \frac{1}{7^2} = \frac{1}{49}$

b.  $10^{-4} = \frac{1}{10^4} = \frac{1}{10,000}$

c.  $9^{-2} = \frac{1}{9^2} = \frac{1}{81}$

3. a.  $5^{-3} = \frac{1}{5^3} = \frac{1}{125}$

b.  $2^{-6} = \frac{1}{2^6} = \frac{1}{64}$

c.  $10^{-3} = \frac{1}{10^3} = \frac{1}{1,000}$

4. a.  $10^{-1} = \frac{1}{10^1} = \frac{1}{10}$

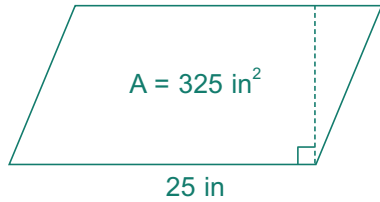
b.  $4^{-2} = \frac{1}{4^2} = \frac{1}{16}$

c.  $6^{-2} = \frac{1}{6^2} = \frac{1}{36}$



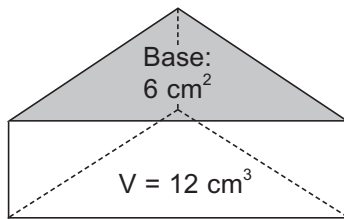
## We Remember

Use the formula to find the height of the parallelogram.



5. The height is \_\_\_\_\_.

Use the volume formula to find the height of the triangular prism.



6. The height is \_\_\_\_\_.

Write the products.

7. a.  $10^0 =$  \_\_\_\_\_      b.  $10^1 =$  \_\_\_\_\_      c.  $53^0 =$  \_\_\_\_\_      d.  $72^1 =$  \_\_\_\_\_

Solve. Use proportions if necessary.

8. What is  $\frac{5}{6}$  of 24? \_\_\_\_\_

9. 6 is  $\frac{3}{8}$  of what number? \_\_\_\_\_

10. 22 is what fraction of 33? \_\_\_\_\_

Write the quotients.

11. a.  $-56 \div 7 =$  \_\_\_\_\_      b.  $\frac{17}{-16} =$  \_\_\_\_\_      c.  $9 \overline{)54}$

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12. Elmer Lapp's cattle feed expenses were  $87\frac{1}{2}\%$  of all his farm expenses. If his farm expenses totaled \$7,200, how much went for cattle feed? Change the percent to its fractional equivalent to solve the problem. \_\_\_\_\_



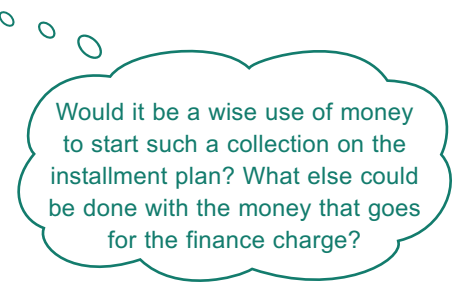
13. A gift edition of a classic children's book costs \$49.50. If you purchase the book on the installment plan, the finance charge is \$10.50. What percent of the original price is the finance charge? Round your answer to the nearest tenth of a percent. \_\_\_\_\_



14. Mary saw a collectible china plate advertised for \$39.99. The advertisement offered to let the buyer have the plate for only \$12.99 down, and four monthly payments of \$9.25.

a. What is the cost of the plate on the installment plan?  
\_\_\_\_\_

b. What is the finance charge on this plan? \_\_\_\_\_



List the prime factors using exponents if possible.

15.  $180 =$  \_\_\_\_\_

16.  $63 =$  \_\_\_\_\_

## — ?... Mental Math —

17.  $10^3 + 100 \div 11 + \sqrt{144} - 12 \div 10 =$

—  $\pm$   $\times$  Skill Builders —

Write the remainder with R.

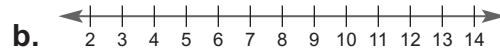
18. a.  $\frac{4}{5} \times \frac{7}{12} \times \frac{5}{7} = \underline{\hspace{2cm}}$

b.  $\begin{array}{r} 642 \\ \times 2.5 \\ \hline \end{array}$

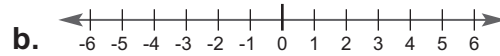
c.  $715 \overline{)48,632}$

Solve each inequality. Graph the solutions.

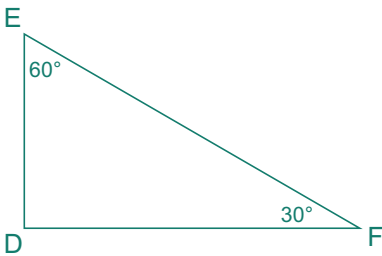
19. a.  $n - 13 \leq -3$



20. a.  $x + 1 < 0$

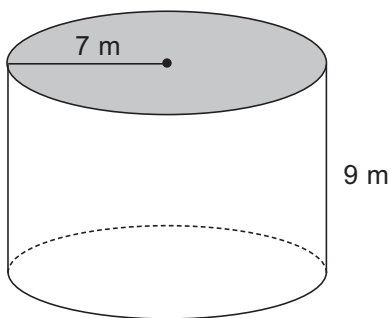


Solve for the unknown angle measure.



21.  $m\angle D = \underline{\hspace{2cm}}$

Use the formula to find the volume of the cylinder.



22.  $\underline{\hspace{4cm}}$

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**Mastery Drill** 

- 23. A reflex angle measures between \_\_\_\_\_° and \_\_\_\_\_°.
- 24. Any number (except 0) with an exponent of \_\_\_\_\_ equals 1.
- 25. Any number with an exponent of \_\_\_\_\_ equals the number itself.
- 26. The formula for finding the area of a triangle is \_\_\_\_\_.
- 27. a. 1 mile  $\approx$  \_\_\_\_\_ kilometers                      b. 1 kilometer  $\approx$  \_\_\_\_\_ mile
- 28. a. The fraction for  $0.\overline{3}$  is \_\_\_\_\_                      b. The fraction for  $0.1\overline{6}$  is \_\_\_\_\_.
- 29. a. The fraction for  $0.8\overline{3}$  is \_\_\_\_\_                      b. The fraction for  $0.\overline{6}$  is \_\_\_\_\_.

**Solve. Round to the nearest cent.**

- 30. Original price of \$11.49 with decrease of 25%.
  - a. Amount of decrease: \_\_\_\_\_
  - b. New price: \_\_\_\_\_
- 31. 82% more than \$55 = \_\_\_\_\_

**Solve and check.**

- 32. a.  $12 + \frac{y}{6} = 24$                       b.                       c.  $10 = \frac{y}{6} + 8$                       d.

**Write the products first with an exponent in the denominator, then as a common fraction.**

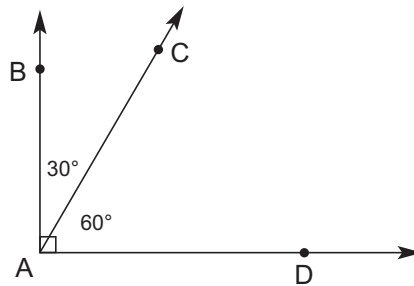
- 33.  $2^{-2} = \frac{\quad}{\quad} = \frac{\quad}{\quad}$
- 34.  $10^{-2} = \frac{\quad}{\quad} = \frac{\quad}{\quad}$
- 35.  $5^{-2} = \frac{\quad}{\quad} = \frac{\quad}{\quad}$

# Lesson 14



## Complementary and Supplementary Angles

**Complementary angles** are two angles whose sum equals  $90^\circ$ .  $\angle BAC$  and  $\angle CAD$  are complementary angles.

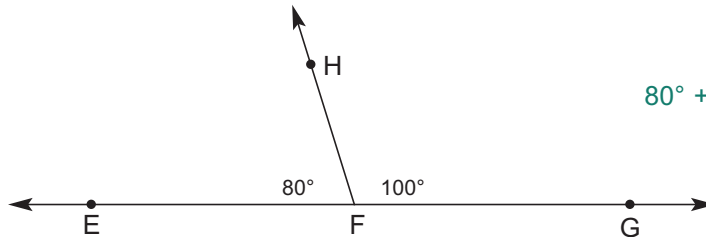


$$30^\circ + 60^\circ = 90^\circ$$

The words: "The measure of angle BAC plus the measure of angle CAD equals  $90^\circ$ ."

The symbols:  $m\angle BAC + m\angle CAD = 90^\circ$

**Supplementary angles** are two angles whose sum equals  $180^\circ$ .  $\angle HFE$  and  $\angle HFG$  are supplementary angles.



$$80^\circ + 100^\circ = 180^\circ$$

The words: "The measure of angle HFE plus the measure of angle HFG equals  $180^\circ$ ."

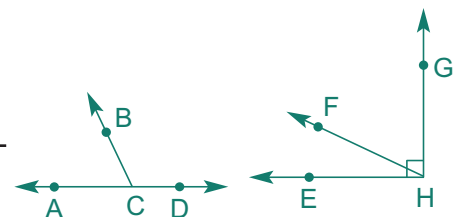
The symbols:  $m\angle HFE + m\angle HFG = 180^\circ$

**Write the answers.**

- The sum of the measures of complementary angles equals \_\_\_\_\_ $^\circ$ .
- The sum of the measures of supplementary angles equals \_\_\_\_\_ $^\circ$ .

**Name the angles.**

- Name the complementary angles. \_\_\_\_\_ and \_\_\_\_\_
- Name the supplementary angles. \_\_\_\_\_ and \_\_\_\_\_



## Lesson 14

Write complementary and supplementary.

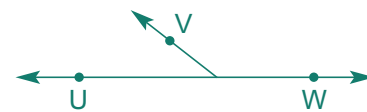
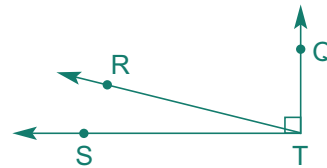
5. \_\_\_\_\_ angles are two angles whose measures equal  $180^\circ$ .

6. \_\_\_\_\_ angles are two angles whose measures equal  $90^\circ$ .

Write complementary and supplementary.

7.  $\angle QTR$  and  $\angle RTS$  are \_\_\_\_\_ angles.

8.  $\angle UXV$  and  $\angle VXW$  are \_\_\_\_\_ angles.



## We Remember

Write the products first with an exponent in the denominator, then as a common fraction.

9. a.  $2^{-4} = \frac{\quad}{\quad} = \frac{\quad}{\quad}$

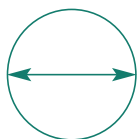
b.  $12^{-2} = \frac{\quad}{\quad} = \frac{\quad}{\quad}$

c.  $3^{-3} = \frac{\quad}{\quad} = \frac{\quad}{\quad}$

Find the total cost.

10. \$16.60 with 8% sales tax = \_\_\_\_\_

Use the circumference formula to find the diameter of the circle. Use 3.14 for pi.



$C = 15.7$  m

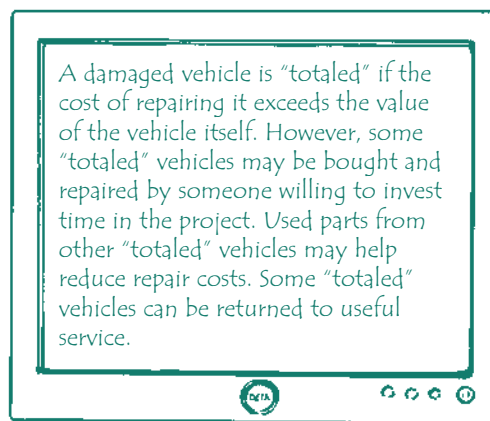
11. The diameter is \_\_\_\_\_.

Convert.

12. a.  $1.02$  g = \_\_\_\_\_ mg

b.  $3.1$  L = \_\_\_\_\_ mL

c.  $1.6$  km = \_\_\_\_\_ m

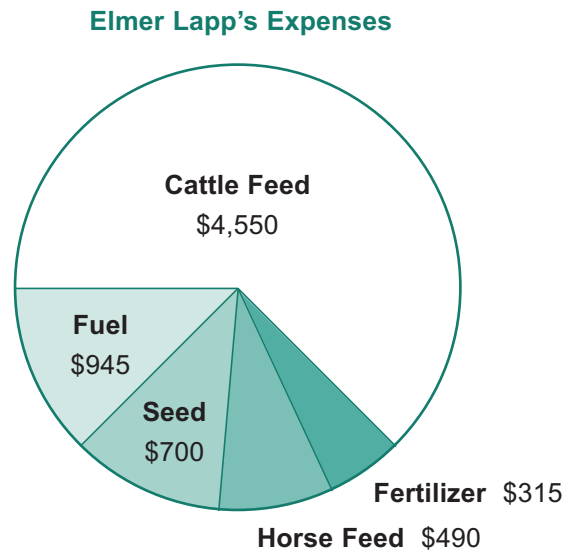



A damaged vehicle is "totaled" if the cost of repairing it exceeds the value of the vehicle itself. However, some "totaled" vehicles may be bought and repaired by someone willing to invest time in the project. Used parts from other "totaled" vehicles may help reduce repair costs. Some "totaled" vehicles can be returned to useful service.

Victor gathered information from Elmer Lapp, one of his farming clients. The graph shows Elmer's expenses for the last quarter of the year.

Find the percent for each sector of the circle graph. The answers for numbers 16 and 18 will be fraction percents.

13. Mr. Lapp's total expenses for the last quarter were \_\_\_\_\_.
14. Cattle feed was \_\_\_\_\_ % of the total.
15. Horse feed was \_\_\_\_\_ % of the total.
16. Fuel was \_\_\_\_\_ % of the total.
17. Seed was \_\_\_\_\_ % of the total.
18. Fertilizer was \_\_\_\_\_ % of the total.



 **19.** Louis totaled the family minivan when he accidentally hit a deer on an icy road and rolled the vehicle. He is thinking about buying a similar used van for \$7,500, but he has only \$4,500 available to spend. Louis plans to make a down payment of \$4,500 and pay the rest on 36 monthly payments of \$145.00.



Louis must decide whether to settle for a lower priced vehicle, or pay the high finance charge.

- a. How much will the minivan cost on the installment plan?  
\_\_\_\_\_
- b. How much will the finance charge be? \_\_\_\_\_



Lesson 14

**+** **x** Skill Builders

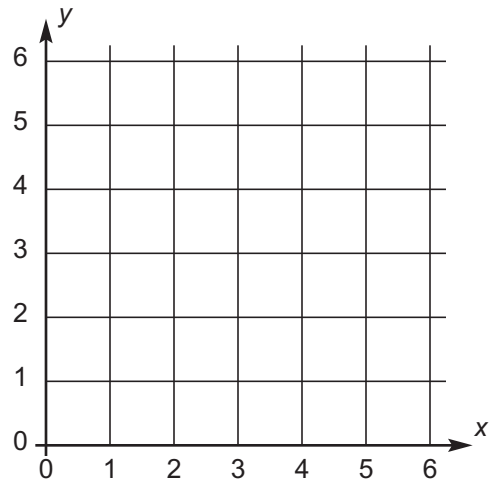
Write the repeating decimal with a bar.

20. a.  $7 \overline{) 24 \text{ hr } 37 \text{ min}}$       b.  $\begin{array}{r} 1,234 \\ \times 567 \\ \hline \end{array}$

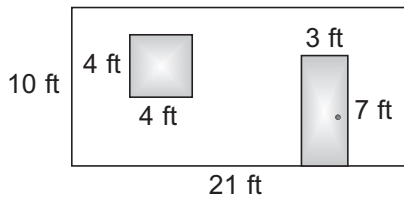
c.  $27 \overline{) 84}$

Plot and label each point on the graph.

21. a. A (1, 2)                      b. B (5, 4)  
 22. a. C (3, 6)                      b. D (6, 4)  
 23. a. E (0, 5)                      b. F (4, 1)  
 24. a. G (3, 4)                      b. H (2, 0)



The diagram shows a wall that Dawn wants to re-paper. Find the number of square feet to be papered, excluding the door and the window.



25. \_\_\_\_\_

Write the percents as decimals.

26. a. 240% = \_\_\_\_\_      b. 128% = \_\_\_\_\_

Find the total income.

27. A salesman receives a salary of \$2,166 per month plus 6% commission on sales of \$8,560. \_\_\_\_\_

## Mastery Drill

28. The *less than or equal to* symbol is \_\_\_\_\_.
29. Any number (except 0) with an exponent of \_\_\_\_\_ equals 1.
30. Any number with an exponent of \_\_\_\_\_ equals the number itself.
31. The formula for finding the volume of a cylinder is \_\_\_\_\_.
32. The four angles made by two intersecting lines measure a total of \_\_\_\_\_°.
33. The formula for finding the volume of a rectangular prism is \_\_\_\_\_.
34. The formula for finding the perimeter of a rectangle or parallelogram is \_\_\_\_\_.
35. a. *Centi* means \_\_\_\_\_.      b. *Deci* means \_\_\_\_\_.      c. *Kilo* means \_\_\_\_\_.

### Change to fractions.

36. a.  $75\% =$  \_\_\_\_\_      b.  $20\% =$  \_\_\_\_\_      c.  $40\% =$  \_\_\_\_\_      d.  $10\% =$  \_\_\_\_\_

### Simplify, solve, and check.

37. a.  $6n + 15 \div 3 = 6 \times 7 + 5$
- b. \_\_\_\_\_

### Write complementary and supplementary.

38. \_\_\_\_\_ angles are two angles whose measures equal  $90^\circ$ .
39. \_\_\_\_\_ angles are two angles whose measures equal  $180^\circ$ .

### Name the angles.

40. Name the complementary angles. \_\_\_\_\_ and \_\_\_\_\_
41. Name the supplementary angles. \_\_\_\_\_ and \_\_\_\_\_

