# حل تجميعة أسئلة وفق الهيكل الوزاري ريفيل

تاريخ نشر الملف على موقع المناهج: 2023-12-01 15:30:45

# التواصل الاجتماعي بحسب الصف الثامن

## روابط مواد الصف الثامن على تلغرام

| الرياضيات | اللغة الانجليزية | اللغة العربية | التربية الاسلامية |
|---|---|---|---|

# المزيد من الملفات بحسب الصف الثامن والمادة رياضيات في الفصل الأول

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# EOT Coverage Term 1

## Gr-8 GEN

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# Unit 1

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**Write each expression using exponents.** (Examples 1 and 2)

**1.** $(-7) \cdot (-7) \cdot 5 \cdot 5 \cdot 5 \cdot 5 = $ _____

**2.** $n \cdot n \cdot p \cdot p \cdot r \cdot r \cdot r = $ _____

$$(-7)^2 \bullet 5^4$$

*ANSWER:*

$n_2 \bullet p_2 \bullet r_3$

**Evaluate each numerical expression.** (Example 3)

**3.** $3^4 - (-4)^2 = $ _____

**4.** $6 + 2^6 = $ _____

34 – (–4)2 Write the expression.
= 81 – (–4)2 34 means 3 • 3 • 3 • 3, or 81.
= 81 – 16 (–4)2 means (–4) • (–4), or 16.
= 65 Subtract.

6 + 26 Write the expression.
= 6 + 64 26 means 2 • 2 • 2 • 2 • 2 •
2, or 64.
= 70 Add

**5.** Evaluate $x^3 - y^2$ if $x = 2$ and $y = \frac{3}{4}$.

(Example 4)

$x^3 - y^2$ Write the expression.

$= 2^3 - (\quad)^2$ Replace $x$ with 2 and $y$ with .

$= 8 -$ Evaluate the powers.

$=$ Subtract.

**6.** Evaluate $(g + h)^3$ if $g = 2$ and $h = -3$.

(Example 5)

$(g + h)^3$ Write the expression.

$= [2 + (-3)]^3$ Replace $g$ with 2 and $h$ with $-3$.

$= [-1]^3$ Add.

$= -1$ Evaluate the power.

**7.** Replace $\square$ with $<$, $>$, or $=$ to make a true statement: $(-3)^4 \square (-4)^3$.

Evaluate $(-3)^4$.

$(-3)^4 = (-3) \cdot (-3) \cdot (-3) \cdot (-3)$

$= 81$

Evaluate $(-4)^3$.

$(-4)^3 = (-4) \cdot (-4) \cdot (-4)$

$= -64$

Compare 81 and $-64$. Because 81 is greater than $-64$, $(-3)^4 > (-4)^3$.

**8.** A scientist estimates that, after a certain amount of time, there would be $2^5 \cdot 3^3 \cdot 10^5$ bacteria in a Petri dish. How many bacteria is this?

$2^5 \cdot 3^3 \cdot 10^5$ Write the expression.
$= 32 \cdot 27 \cdot 100{,}000$ Evaluate the powers.
$= 86{,}400{,}000$ Multiply.
So, there will be 86,400,000 bacteria in the Petri dish.

**Test Practice**

**9. Multiselect** Select all of the expressions that evaluate to negative rational numbers.

6561
✗ ☐ $(-9)^4$

✓ ☐ $\left(-\dfrac{4}{5}\right)^3$ $= \dfrac{-64}{125}$

✓ ☐ $3^5 - 10^4$  $243 - 10{,}000 = -9{,}757$

✓ ☐ $(9.8)^2 - 10^2$

✗ ☐ $\left(-\dfrac{3}{8}\right)^2 - \dfrac{3^2}{8^2} = \dfrac{9}{64}$

9. **Multiselect** Select all of the expressions that evaluate to negative rational numbers.
$(-9)^4$
$(\quad)^3$
$3^5 - 10^4$
$(9.8)^2 - 10^2$
$(\quad)$

## Simplify each expression. (Examples 1–3)

**1.** $3^8 \cdot 3 = $ _____

SOLUTION:

| | |
|---|---|
| $3^8 \cdot 3$ | Write the expression. |
| $= 3^8 \cdot 3^1$ | $3 = 3^1$ |
| $= 3^{8+1}$ | Product of Powers Property |
| $= 3^9$ or 19,683 | Add the exponents. Simplify. |

**2.** $m^5 \cdot m^2 = $ _____

SOLUTION:

| | |
|---|---|
| $m^5 \cdot m^2$ | Write the expression. |
| $= m^{5+2}$ | Product of Powers Property |
| $= m^7$ | Simplify. |

**3.** $3m^3n^2 \cdot 8mn^3 = $

SOLUTION:

$3m^3n^2 \cdot 8mn^3$

$= (3 \cdot m^3 \cdot n^2) \cdot (8 \cdot m \cdot n^3)$

$= (3 \cdot 8)(m^3 \cdot m)(n^2 \cdot n^3)$

$= 24(m^3 \cdot m)(n^2 \cdot n^3)$

$= 24(m^{3+1})(n^{2+3})$

$= 24m^4n^5$

**4.** $9p^4 \cdot (-8p^2) = $ _____

$9p^4 \cdot (-8p^2)$

$= (9 \cdot p^4) \cdot (-8 \cdot p^2)$

$= (9 \cdot -8)(p^4 \cdot p^2)$

$= -72(p^4 \cdot p^2)$

$= -72p^{4+2}$

$= -72p^6$

**Simplify each expression.** (Examples 1–3)

**5.** Simplify $\dfrac{b^{12}}{b^5}$. (Example 4)

$$= b^{12-5}$$
$$= b^7$$

**6.** Simplify $\dfrac{5^5 \cdot 6^3 \cdot 8^{10}}{5^3 \cdot 6 \cdot 8^9}$. (Example 6)

$$= \left(\dfrac{5^5}{5^3}\right)\left(\dfrac{6^3}{6}\right)\left(\dfrac{8^{10}}{8^9}\right)$$
$$= 5^{5-3} \cdot 6^{3-1} \cdot 8^{10-9}$$
$$= 5^2 \cdot 6^2 \cdot 8^1$$
$$= 25 \cdot 36 \cdot 8$$
$$= 7,200$$

**7.** A publisher sells $10^6$ copies of a new science fiction book and $10^3$ copies of a new mystery book. How many times as many science fiction books were sold than mystery books? (Example 5)

Evaluate $\dfrac{10^6}{10^3}$.

$$\dfrac{10^6}{10^3}$$
$$= 10^{6-3}$$
$$= 10^3$$
$$= 1,000$$

**8.** Simplify $\dfrac{45x^{15}}{9x^{10}}$. (Example 7)

$$= \left(\frac{45}{9}\right)\left(\frac{x^{15}}{x^{10}}\right)$$
$$= 5\left(\frac{x^{15}}{x^{10}}\right)$$
$$= 5(x^{15-10})$$
$$= 5x^5$$

## Apply

**10.** Fouster's Farms has $5^3$ fruit trees on their land. Myrna's Farms has five times as many fruit trees as Fouster's. A commercial farm has 500 fruit trees. Which farm has the most fruit trees?

Evaluate each expression.

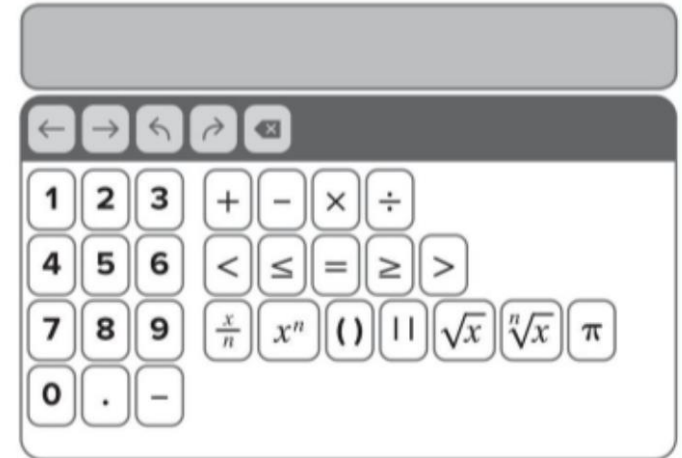| | |
|---|---|
| $5^3$ | Write the expression for Fouster's Farms. |
| $= 125$ | Simplify. Fouster's Farms has 125 fruit trees. |
| | |
| $5^3 \cdot 5$ | Write the expression for Myrna's Farms. |
| $= 5^3 \cdot 5^1$ | $5 = 5^1$ |
| $= 5^{3+1}$ | Product of Powers Property |
| $= 5^4$ | Add the exponents. |
| $= 625$ | Simplify. Myrna's Farms has 625 fruit trees. |

The commercial farm has 500 fruit trees.

Compare 125, 500, and 625. Because $125 < 500 < 625$, Myrna's Farms has the most fruit trees.

**11.** The table shows the number of bacteria in each Petri dish. Dish C has $8^2$ times as many bacteria has Dish A. Which Petri dish holds the most number of bacteria?

A
$$8^6$$
$$= 262{,}144$$

B
$$8^9$$
$$= 134{,}217{,}728$$

| Petri Dish | Number of Bacteria |
|---|---|
| A | $8^6$ |
| B | $8^9$ |

C
$$8^6 \cdot 8^2$$
$$= 8^{6+2}$$
$$= 8^8$$
$$= 16{,}777{,}216$$

Dish B

**9. Equation Editor** Simplify $\dfrac{a^4 c^6}{a^2 c}$.

$$= \left(\frac{a^4}{a^2}\right)\left(\frac{c^6}{c}\right)$$
$$= (a^{4-2})(c^{6-1})$$
$$= a^2 c^5$$

**12.** Write a multiplication expression with a product of $8^{13}$.

$$8^5 \cdot 8^8 = 8^{5+8} \text{ or } 8^{13}$$

**14.** **MP** **Identify Repeated Reasoning** Consider the sequence below:

$$2, 4, 8, 16, 32, 64, \ldots$$

The number 4,096 belongs to this sequence. What is the number that immediately precedes it?

Sample answer: In the sequence, each term is two times the previous term. To find the term before 4,096, divide 4,096 by two. $4,096 \div 2 = 2,048$. The term is 2,048.

**15.** What value of $n$ makes a true statement?

$$4^n \cdot 4^2 = 16,384$$

$$16,384 = 4^7$$
$$4^n \cdot 4^2 = 4^7$$
$$4^{n+2} = 4^7$$
$$4^{5+2} = 4^7$$

**13.** **MP** **Persevere with Problems** What is four times $4^{15}$? Write using exponents and explain your reasoning.

$4^{16}$; four times $4^{15}$ translates to $4 \cdot 4^{15}$ which simplifies to $4^{1+15}$ or $4^{16}$.

## Practice..

**Simplify each expression.** (Examples 1–4)

**1.** $(7^2)^3 =$ _____
$$= 7^{2 \cdot 3}$$
$$= 7^6 \text{ or } 117{,}649$$

**2.** $(8^3)^3 =$
$$(8^3)^3$$
$$= 8^{3 \cdot 3}$$
$$= 8^9 \text{ or } 134{,}217{,}728$$

**3.** $(d^7)^6 =$ _____
$$= d^{7 \cdot 6}$$
$$= d^{42}$$

**4.** $(z^7)^3 =$ _____
$$= z^{7 \cdot 3}$$
$$= z^{21}$$

**5.** $(2m^5)^6 =$ _____
$$= 2^6 \cdot (m^5)^6$$
$$= 2^6 \cdot m^{5 \cdot 6}$$
$$= 64m^{30}$$

**6.** $(7a^5b^6)^4 =$ _____
$$= 7^4 \cdot (a^5)^4 \cdot (b^6)^4$$
$$= 7^4 \cdot a^{5 \cdot 4} \cdot b^{6 \cdot 4}$$
$$= 2{,}401a^{20}b^{24}$$

**7.** $(-3w^3z^8)^5 =$ _____
$$= (-3)^5 \cdot (w^3)^5 \cdot (z^8)^5$$
$$= (-3)^5 \cdot w^{3 \cdot 5} \cdot z^{8 \cdot 5}$$
$$= -243w^{15}z^{40}$$

**8.** $(-5r^4s^{10})^4 =$ _____
$$= (-5)^4 \cdot (r^4)^4 \cdot (s^{10})^4$$
$$= (-5)^4 \cdot r^{4 \cdot 4} \cdot s^{10 \cdot 4}$$
$$= 625r^{16}s^{40}$$

**9.** Which is greater: 1,000 or $(6^2)^3$? Explain.

Evaluate $(6^2)^3$.

$(6^2)^3 = 6^{2 \cdot 3}$        Power of a Power Property

     $= 6^6$ or 46,656     Simplify.

Compare 1,000 and 46,656. Because 46,656 is greater than 1,000, $(6^2)^3 > 1,000$.

**Test Practice**

**10. Multiselect** Select all of the expressions that simplify to the same expression.

☐ $(x^3y^4)^2$

☐ $(x^2y)^2$

☐ $(x^3)^2y^6$

☐ $x^6(y^4)^2$

☐ $(x^3)^2(y^2)^4$

*ANSWER:*

$(x^3y^4)^2, \; x^6(y^4)^2, \; (x^3)^2(y^2)^4$

**Simplify each expression.** (Example 1)

1. $46^0 =$ _____    $46^0$
     $= 1$

2. $w^0$, where $w \neq 0$    $1$

**Express each using a positive exponent.**

(Example 2)

3. $8^{-4} =$ _____ $= \dfrac{1}{8^4}$

4. $y^{-9} =$ _____ $\dfrac{1}{y^9}$

**Express each fraction using a negative exponent.** (Example 3)

5. $\dfrac{1}{d^6} =$ _____ $d^{-6}$

6. $\dfrac{1}{10^5} =$ _____ $10^{-5}$

## Simplify each expression. (Examples 4 and 5)

**7.** $9^4 \cdot 9^{-6} =$ _____

$$= 9^{4+(-6)}$$
$$= 9^{-2}$$
$$= \frac{1}{9^2}$$
$$= \frac{1}{81}$$

**8.** $y^{-9} \cdot y^3 =$ _____

$$\frac{1}{y^6}$$

**9.** $\dfrac{x^{-8}}{x^{-12}} =$ _____

$$= x^{(-8)-(-12)}$$
$$= x^4$$

**10.** $\dfrac{d^{-13}}{d^{-2}} =$ _____

$$= d^{(-13)-(-2)}$$
$$= d^{-11}$$
$$= \frac{1}{d^{11}}$$

**11.** Simplify $8^{-7} \cdot 8^7 \cdot 10^4 \cdot 10^{-4}$.

$$8^{-7} \cdot 8^7 \cdot 10^4 \cdot 10^{-4}$$
$$= 8^{-7+7} \cdot 10^{4+(-4)}$$
$$= 8^0 \cdot 10^0$$
$$= 1 \cdot 1$$
$$= 1$$

### Test Practice

**12. Multiselect** Select all of the expressions that are simplified.

- [ ] $n^4$
- [ ] $\dfrac{1}{n^{-5}}$
- [ ] $n^6 \cdot n^{-8}$
- [ ] $n^7 \cdot p^8$
- [ ] $\dfrac{1}{n^3}$

$$n^4, n^7 \cdot p^8, \frac{1}{n^3}$$

**Practice..**

## Write each number in standard form. (Examples 1 and 2)

**1.** $1.6 \times 10^3 =$ $= 1{,}600$

**2.** $1.49 \times 10^{-7} =$ $= 0.000000149$

**3.** A calculator screen shows a number in scientific notation as 8.3E−6. Write this number in standard form. (Example 3)

$= 8.3 \times 10^{-6}$

$= 0.0000083$

**4.** A calculator screen shows a number in scientific notation as 7E11. Write this number in standard form. (Example 3)

$= 7 \times 10^{11}$

$= 700{,}000{,}000{,}000$

## Write each number in scientific notation. (Examples 4 and 5)

**5.** $2{,}204{,}000{,}000 =$ _____

$= 2.204 \times 1{,}000{,}000{,}000$

$= 2.204 \times 10^9$

**6.** $0.0000000642 =$

$= 6.42 \times 0.0000001$

$= 6.42 \times \dfrac{1}{10^8}$

$= 6.42 \times 10^{-8}$

**7.** A common race is a 5K race, where runners travel 5 kilometers. Is it more appropriate to report the distance as 5 kilometers or $5 \times 10^6$ millimeters? Explain your reasoning. (Example 6)

The number $5 \times 10^6$ millimeters is unnecessarily large and would be difficult to visualize. Choosing the larger unit of measure, 5 kilometers, is more appropriate.

**8.** The population of Florida was recently recorded as 20,612,439 people. Write an estimation in scientific notation for the population. (Example 7)

$20,612,439 \approx 20,000,00$
$20,000,000 = 2 \times 10,000,000$
$= 2 \times 10^7$

**9.** The diameter of a grain of sand is 0.0024 inch. Write an estimation in scientific notation for the diameter. (Example 7)

$$0.0024 \approx 0.002$$
$$0.002 = 2 \times 0.001$$
$$= 2 \times \frac{1}{10^3}$$
$$= 2 \times 10^{-3}$$

**10. Equation Editor** The mass of planet Earth is about $5.98 \times 10^{24}$ kilograms. When this number is written in standard notation, how many zeros are in the number?



$$5.98 \times 10^{24}$$
$$= 5,980,000,000,000,000,000,000,000$$

1. There are about $3 \times 10^{11}$ stars in our galaxy and about 100 billion galaxies in the observable universe. Suppose every galaxy has as many stars as ours. How many stars are in the observable universe? Write in scientific notation.
   (Example 1)

$$(3 \times 10^{11}) \times (1 \times 10^{11})$$
$$= (3 \times 1) \times (10^{11} \times 10^{11})$$
$$= (3) \times (10^{11} \times 10^{11})$$
$$= 3 \times 10^{11+11}$$
$$= 3 \times 10^{22}$$

2. Humpback whales are known to weigh as much as 80,000 pounds. The tiny krill they eat weigh only $2.1875 \times 10^{-3}$ pound. About how many times greater is the weight of a humpback whale? (Example 2)

Write the weight of the whale in scientific notation.
$$80{,}000 = 8 \times 10^{4}$$

Since we are estimating, round 2.1875 to the nearest whole number.
$$2.1875 \approx 2$$

Divide the weight of the whale by the estimated weight of the krill.

$$\frac{8 \times 10^{4}}{2 \times 10^{-3}} = \frac{8}{2} \times \frac{10^{4}}{10^{-3}} \qquad \text{Associative Property}$$

$$= 4 \times \left( \frac{10^{4}}{10^{-3}} \right) \qquad \text{Divide 8 by 2.}$$

$$= 4 \times 10^{4-(-3)} \qquad \text{Quotient of Powers Property}$$

$$= 4 \times 10^{7} \qquad \text{Subtract the exponents.}$$

**Evaluate. Express each result in scientific notation.** (Example 3)

**3.** $(1.28 \times 10^5) + (1.13 \times 10^3) =$

$(1.28 \times 10^5) + (1.13 \times 10^3)$
$= (128 \times 10^3) + (1.13 \times 10^3)$
$= (128 + 1.13) \times 10^3$
$= 129.13 \times 10^3$
$= 1.2913 \times 10^5$

**4.** $(7.26 \times 10^6) - (1.3 \times 10^4) =$

$(7.26 \times 10^6) - (1.3 \times 10^4)$
$= (726 \times 10^4) - (1.3 \times 10^4)$
$= (726 - 1.3) \times 10^4$
$= 724.7 \times 10^4$
$= 7.247 \times 10^6$

**5.** The speed of light is about $1.86 \times 10^5$ miles per second. The star Sirius is about $5.062 \times 10^{13}$ miles from Earth. About how many seconds does it take light to travel from Sirius to Earth? Write in scientific notation, rounded to the nearest hundredth.

Divide the distance by the speed of light.

$$\frac{5.062 \times 10^{13}}{1.86 \times 10^5} = \frac{5.062}{1.86} \times \frac{10^{13}}{10^5}$$

$$\approx 2.72 \times \frac{10^{13}}{10^5}$$

$$\approx 2.72 \times 10^{13-(5)}$$

$$\approx 2.72 \times 10^8$$

**6. Table Item** The table shows the amount of money raised by each region. The four regions raised a total of $(5.38 \times 10^4)$. How much did the West raise?

| Region | Amount Raised ($) |
|--------|-------------------|
| East | $1.46 \times 10^4$ |
| North | $2.38 \times 10^4$ |
| South | $6.75 \times 10^3$ |
| West | |

Write $6.75 \times 10^3$ as $0.675 \times 10^4$.

To find the sum of the known regions, find $(1.46 \times 10^4) + (2.38 \times 10^4) + (0.675 \times 10^4)$.

$= \$(1.46 + 2.38 + 0.675) \times 10^4$     Commutative and Associative Properties

$= \$(4.515 \times 10^4)$     Simplify.

To find the unknown region, find $(5.38 \times 10^4) - \$(4.515 \times 10^4)$.

$= \$(5.38 - 4.515) \times 10^4$     Distributive Property

$= \$(0.865) \times 10^4$     Simplify.

$= \$(8.65) \times 10^3$     Rewrite in scientific notation.

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# Unit 2

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# Practice..

**Write each rational number in decimal form. Then determine whether the decimal is a terminating decimal.** (Examples 1 and 2)

**1.** $-\dfrac{11}{16} =$ _____

$-\dfrac{11}{16}$ means $-11 \div 16$. Divide 11 by 16 and add the negative sign.

Place the decimal point. Annex zeros and divide as with whole numbers.

$$
\begin{array}{r}
.6875 \\
16\overline{)110000} \\
-96 \\
\hline
140 \\
-128 \\
\hline
120 \\
-112 \\
\hline
80 \\
-80 \\
\hline
0
\end{array}
$$

$-\dfrac{11}{16} = -0.6875$

**−0.6875; terminating**

**2.** $\dfrac{5}{33} =$ _____

$\dfrac{5}{33}$ means $5 \div 33$. Divide 5 by 33.

Place the decimal point. Annex zeros and divide as with whole numbers.

$$
\begin{array}{r}
.1515... \\
33\overline{)50000} \\
-33 \\
\hline
170 \\
-165 \\
\hline
50 \\
-33 \\
\hline
170 \\
-165 \\
\hline
5
\end{array}
$$

**not terminating**

$\dfrac{5}{33} = 0.\overline{15}$

So, $0.\overline{15}$ is not a terminating decimal because the repeating digit is not zero.

**3.** $4\dfrac{3}{8} =$

$4\dfrac{3}{8}$ can be rewritten as $\dfrac{35}{8}$. Divide 35 by 8.

$$
\begin{array}{r}
4.375 \\
8\overline{)35000} \\
-32 \\
\hline
30 \\
-24 \\
\hline
60 \\
-56 \\
\hline
40 \\
-40 \\
\hline
0
\end{array}
$$

**terminating**

$4\dfrac{3}{8} = 4.375$

**4.** $-9\dfrac{11}{30} =$

$-9\dfrac{11}{30}$ can be rewritten as $-\dfrac{281}{30}$. Divide 281 by 30 and add a negative sign.

$$
\begin{array}{r}
9.366... \\
30\overline{)281000} \\
-270 \\
\hline
110 \\
-90 \\
\hline
200 \\
-180 \\
\hline
200 \\
-180 \\
\hline
20
\end{array}
$$

**not terminating**

**Write each decimal as a fraction or mixed number in simplest form.** (Examples 3 and 4)

**5.** $0.\overline{8} =$ $\boxed{\dfrac{8}{9}}$

**6.** $-0.\overline{18} =$ $\boxed{= -\dfrac{18}{99} \\ = -\dfrac{2}{11}}$

**7.** $-1.\overline{5} =$ $\boxed{1\dfrac{5}{9}}$

**8.** $4.\overline{45} =$ _____

$$\boxed{N = 4\dfrac{45}{99} \text{ or } 4\dfrac{5}{11}}$$

**9.** One pint is about $\frac{5}{9}$ liter. Write $\frac{5}{9}$ as a decimal.

$\frac{5}{9}$ means 5 ÷ 9. Divide 5 by 9.

Place the decimal point. Annex zeros and divide as with whole numbers.

```
    .555...
9)5000
   -45
    50
   -45
    50
   -45
     5
```

The remainder will never be 0. The digit 5 is repeating. So, $\frac{5}{9} = 0.\overline{5}$.

**10.** Phoebe won $\frac{7}{16}$ of the competitions she entered. Write $\frac{7}{16}$ as a decimal.

$\frac{7}{16}$ means 7 ÷ 16. Divide 7 by 16.

Place the decimal point. Annex zeros and divide as with whole numbers.

```
    .4375
16)70000
   -64
    60
   -48
    120
   -112
     80
    -80
      0
```

The repeating digit is 0. So, $\frac{7}{16} = 0.4375$.

**11.** Write the decimal 5.666... as a mixed number in simplest form.

$N = 5\frac{6}{9}$ or $5\frac{2}{3}$

ANSWER:

$\frac{1}{225}, \frac{7}{26}$

**12. Multiselect** Select all of the fractions that, when converted, result in a non-terminating decimal.

- ☐ $-\frac{11}{5}$
- ☐ $\frac{1}{225}$
- ☐ $\frac{5}{16}$
- ☐ $\frac{1}{50}$
- ☐ $\frac{7}{26}$
- ☐ $-\frac{3}{32}$

**PG. 77**

**Simplify using rational numbers. If the expression cannot be simplified, explain why.** (Examples 1–4)

**1.** $\sqrt{361} =$ $\boxed{\sqrt{361} = 19}$

**2.** $\pm\sqrt{1.96} =$ $\boxed{\begin{array}{l} 1.4 \times 1.4 \\ \text{equal } 2. \\ = 1.96 \\ \\ \text{So, } \pm\sqrt{1.96} = \pm 1.4. \end{array}}$

**3.** $-\sqrt{\dfrac{9}{16}} =$ $\boxed{-\dfrac{3}{4}}$

**4.** $\sqrt{-441} =$ $\boxed{\text{The expression cannot be simplified.} \\ -441.}$

**5.** Solve $m^2 = 0.04$. (Example 5) $\boxed{\begin{array}{l} \pm\sqrt{m} = \pm\sqrt{0.04} \\ \\ m = \pm 0.2 \\ m = 0.2 \text{ and } m = -0.2 \end{array}}$

**7.** $\sqrt[3]{-512} =$ _____

$\boxed{\sqrt[3]{-512} = -8 \qquad (-8)^3 = -8 \cdot -8 \cdot -8 \text{ or } -512}$

**Simplify using rational numbers.** (Examples 6 and 7)

**6.** $\sqrt[3]{343} =$ $\boxed{\sqrt[3]{343} = 7 \qquad 7^3 = 7 \cdot 7 \cdot 7 \text{ or } 343}$

**8.** A basin of a water fountain is cube shaped and has a volume of 91.125 cubic feet. Solve $s^3 = 91.125$ to find the length $s$ of one side of the basin. (Example 8)

Convert 91.125 to $\dfrac{729}{8}$.

$s^3 = \dfrac{729}{8}$　　　Write the equation.

$\sqrt[3]{s} = \sqrt[3]{\dfrac{729}{8}}$　　　Take the cube root of each side.

$s = \dfrac{9}{2}$　　　Definition of cube root

$s = 4\dfrac{1}{2}$ or 4.5　　　Simplify.

**9.** Moesha has 196 pepper plants that she wants to plant in a square formation. How many pepper plants should she plant in each row?

Find the square root of 196.

$\sqrt{196} = 14$　　　Find the positive square root of 196; $14^2 = 196$.

**11.** A cement path consists of six equal-sized cement squares arranged in a row to form a rectangle. If the total area of the path is 96 square feet, what is the length in feet of the path?

Let $x$ represent the side length of each square.
Solve the equation $6x^2 = 96$.

$6x^2 = 96$　　　Write the equation.

$x^2 = 16$　　　Divide each side by 6.

$\sqrt{x^2} = \sqrt{16}$　　　Take the positive square root of each side; $4^2 = 16$.

$x = 4$　　　Simplify.

The length of the path is $4 \times 6$ or 24 feet.

**Test Practice**

**10. Equation Editor** What is the value of $p$ in the equation shown?

$p^3 = -0.027$

| ← | → | ↶ | ↷ | ⌫ |

| 1 | 2 | 3 | + | − | × | ÷ |
| 4 | 5 | 6 | < | ≤ | = | ≥ | > |
| 7 | 8 | 9 | $\frac{x}{n}$ | $x^n$ | ( ) | | | $\sqrt{x}$ | $\sqrt[n]{x}$ | $\pi$ |
| 0 | . | − |

$p^3 = -0.027$

$\sqrt[3]{p} = \sqrt[3]{-0.027}$

$p = -0.3$

**12.** A photo collage consists of seven equal-sized square photos arranged in a row to form a rectangle. If the total area of the collage is 567 square inches, what is the length of the collage?

Let $x$ represent the side length of each square photo.

Solve the equation $7x^2 = 567$.

$$7x^2 = 567 \qquad \text{Write the equation.}$$
$$x^2 = 81 \qquad \text{Divide each side by 7.}$$
$$\sqrt{x^2} = \sqrt{81} \qquad \text{Take the positive square root of each side; } 9^2 = 81.$$
$$x = 9 \qquad \text{Simplify.}$$

The length of the collage is $9 \times 7$ or 63 inches.

**13.** **MP** **Reason Inductively** Explain why $\sqrt[3]{8}$ is a rational number, but $\sqrt{8}$ is not a rational number.

The rational number 2, when cubed, results in 8. There is not a rational number that, when multiplied by itself, results in 8.

**14.** Give an example of when the decimal equivalent of a square root would be rounded to an approximate value. Explain why it is appropriate to round.

Not all square roots have exact solutions, for example $\sqrt{13} = 3.60555127....$ If a decimal answer is necessary, rounding to 3.6 would be appropriate.

**PG. 89-90**

**15.** Write a number that completes the analogy:

$x^2$ is to 441 as $x^3$ is to _____.

> The square root of 441 is 21. So, $x = 21$.
>
> Find $x^3$.
> $x^3 = 21^3$      Replace $x$ with 21.
> $\quad = 9{,}261$      $21 \times 21 \times 21 = 9{,}261$

**16.** MP **IDENTIFY REPEATED REASONING** Simplify each expression.

**a.**

$\left(\sqrt{81}\right)^2 =$

> Simplify $\left(\sqrt{81}\right)^2$.
> $= (9)^2$
> $= 81$

**c.**

$\left(\sqrt{0.04}\right)^2$

> $= (0.2)^2$
> $= 0.04$

**b.**

$\left(\sqrt{\frac{9}{16}}\right)^2 = \boxed{\phantom{xx}} = \dfrac{9}{16}$

**d.**

$\left(\sqrt{t}\right)^2$

> $= \left(\sqrt{t}\right)^2$
> $= t$

**Practice..**

**Identify whether each number is *rational* or *irrational*.** (Example 1)

1. $-\sqrt{10}$ — irrational

2. $-\dfrac{3}{11}$ — rational

3. $0.\overline{3}$ — rational

4. $\sqrt{81}$ — rational

5. $0$ — rational

6. $-\dfrac{\sqrt{2}}{2}$ — irrational

7. $\sqrt{7}$ — irrational

8. $\dfrac{\sqrt{2}}{\sqrt{2}}$ — rational

**Select all the sets of numbers to which each real number belongs.** (Examples 2–4)

**9.** $\sqrt[3]{343}$

(A) Rational
(B) Irrational
(C) Integer
(D) Whole
(E) Natural

Rational, Integer, Whole, Natural

**10.** $\dfrac{7}{\sqrt{2}}$

(A) Rational
(B) Irrational
(C) Integer
(D) Whole
(E) Natural

Irrational

**11.** $-\dfrac{7}{1}$

(A) Rational
(B) Irrational
(C) Integer
(D) Whole
(E) Natural

Rational, Integer

**Determine whether each statement is *true* or *false*. If the statement is *true*, explain your reasoning. If the statement is *false*, provide a counterexample.** (Examples 5 and 6)

**12.** A number cannot be irrational and an integer.

true; Sample answer: Irrational numbers cannot be expressed as a ratio $\dfrac{a}{b}$, where $a$ and $b$ are integers and $b \neq 0$. Integers are a subset of rational numbers, which can be expressed as a ratio $\dfrac{a}{b}$. Therefore, a number cannot be irrational and an integer.

**13.** All integers are rational.

true; Sample answer: All integers can be expressed as a ratio $\dfrac{a}{b}$, where $a$ and $b$ are integers and $b \neq 0$, which is the definition of a rational number. Therefore, all integers are rational numbers.

**Estimate each square root or cube root to the nearest integer.** (Examples 1 and 3)

1. $\sqrt{125} \approx$ ___ 11 ___

2. $\sqrt{55} \approx$ _____

Because 55 is closer to 49, you can expect $\sqrt{55}$ to be closer to 7 than 8. So, $\sqrt{55} \approx 7$.

**Estimate each square root or cube root to the nearest integer.** (Examples 1 and 3)

3. $\sqrt[3]{70} \approx$ _____

Because 70 is closer to 64, you can expect $\sqrt[3]{70}$ to be closer to 4 than 5. So, $\sqrt[3]{70} \approx 4$.

4. $\sqrt[3]{923} \approx$ _____

Because 923 is closer to 1,000, you can expect $\sqrt[3]{923}$ to be closer to 10 than 9. So, $\sqrt[3]{923} \approx 10$.

**Estimate each square root to the nearest tenth.** (Example 2)

5. $\sqrt{296} \approx$ _____

$\sqrt{296}$ is between 17.2 and 17.3. 296 is closer to 295.84 than 299.29. So, $\sqrt{296} \approx 17.2$.

6. $\sqrt{5} \approx$ _____

$\sqrt{5}$ is between 2.2 and 2.3. 5 is closer to 4.84 than 5.29. So, $\sqrt{5} \approx 2.2$.

7. $\sqrt{11} \approx$ _____

$\sqrt{11}$ is between 3.3 and 3.4. 11 is closer to 10.89 than 11.56. So, $\sqrt{11} \approx 3.3$.

8. $\sqrt{62} \approx$ _____

$\sqrt{62}$ is between 7.8 and 7.9. 62 is closer to 62.14 than 60.84. So, $\sqrt{62} \approx 7.9$.

**9.** The formula $s = \sqrt{18d}$ can be used to find the speed $s$ of a car in miles per hour when the car needs $d$ feet to come to a complete stop after stepping on the brakes. If it took a car 25 feet to come to a complete stop after stepping on the brakes, estimate the speed of the car. Truncate the value of $\sqrt{18d}$, when $d = 25$, to the tenths place. **(Example 4)**

$$s = \sqrt{18d}$$
$$= \sqrt{18(25)}$$
$$= \sqrt{450}$$
$$\approx 21.21320344$$
$$\approx 21.\cancel{21320344}$$

*ANSWER:*

21.2 miles per hour

**10.** If the area of a square is 32 square feet, estimate the length of each side of the square to the nearest whole number.

$$A = s^2$$
$$32 = s^2$$
$$\sqrt{32} = \sqrt{s}$$
$$6 \approx s$$

**Test Practice**

**11. Equation Editor** Estimate the square root to the nearest tenth.

$\sqrt{489}$

| | | |
|---|---|---|
| 1 | 2 | 3 |
| 4 | 5 | 6 |
| 7 | 8 | 9 |

$\sqrt{489}$ is between 22.1 and 22.2. 489 is closer to 488.41 than 492.84. So, $\sqrt{489} \approx 22.1$.

*ANSWER:*

22.1

Complete each statement using <, >, or =. Then graph the numbers on the
number line. (Examples 1 and 2)

**1.** $\sqrt{11}$ _____<_____ $3\frac{2}{3}$
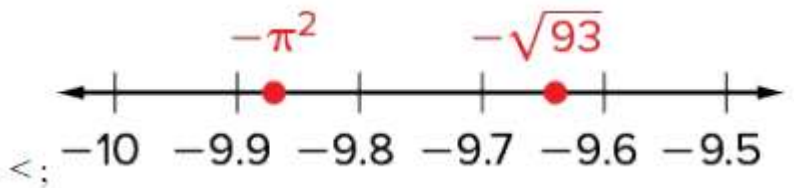
$\sqrt{11} = 3.3166...$

$3\frac{2}{3} = 3.6666...$

$\sqrt{11}$         $3\frac{2}{3}$

3.2   3.3   3.4   3.5   3.6   3.7

**2.** $\sqrt{3}$ _____ $\dfrac{\sqrt{10}}{2}$

$\sqrt{3} \approx 1.7$          Estimate to the nearest tenth.

$\dfrac{\sqrt{10}}{2} \approx 1.6$     Estimate to the nearest tenth.

$\dfrac{\sqrt{10}}{2}$      $\sqrt{3}$

1.4    1.5    1.6    1.7    1.8    1.9

**3.** $-\pi^2$ _____ $-\sqrt{93}$

$-\pi^2 \approx -9.9$          Estimate to the nearest tenth.
$-\sqrt{93} \approx -9.6$      Estimate to the nearest tenth.

Since −9.6 is greater than −9.9, $-\pi^2 < -\sqrt{93}$.

$-\pi^2$              $-\sqrt{93}$
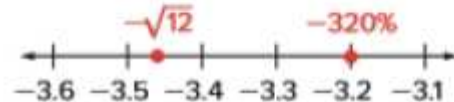
<; −10  −9.9  −9.8  −9.7  −9.6  −9.5
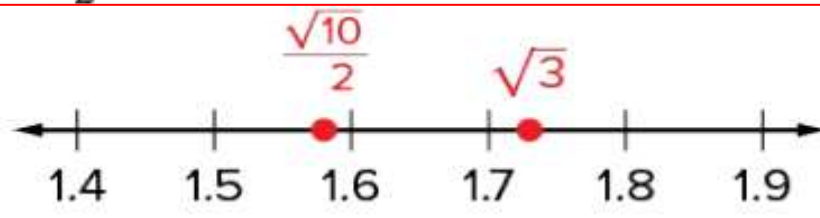
**4.** $-\sqrt{12}$ _____ $-320\%$

Graph the numbers on the number line.
$-\sqrt{12} = -3.4482...$

$-320\% = -3.2$

Approximate the location of each number. Then plot their location on the number line.

$-\sqrt{12}$        $-320\%$

−3.6  −3.5  −3.4  −3.3  −3.2  −3.1

**5.** Order the set $\left\{3\frac{1}{2}, \frac{10}{3}, \pi, \sqrt{13}\right\}$ from least to greatest. Then graph the set on the number line. (Example 3)

$3\frac{1}{2} = 3.5$     Write as a decimal.

$\frac{10}{3} \approx 3.\overline{3}$     Write using bar notation.
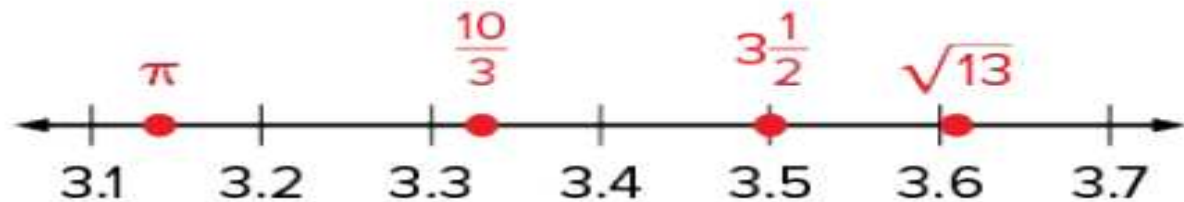
$\pi \approx 3.1$     Estimate to the nearest tenth.

$\sqrt{13} \approx 3.6$     Estimate to the nearest tenth.

Compare the decimals. The decimals from least to greatest are 3.1, 3.$\overline{3}$, 3.5, and 3.6.

So, from least to greatest, the order is $\pi$, $\frac{10}{3}$, $3\frac{1}{2}$, and $\sqrt{13}$.



**6.** The table shows the foul-shot statistics for three players in a recent basketball game. Which player had the greatest foul-shot statistic? (Example 4)

| Player | Foul-Shot Statistic |
|--------|---------------------|
| 1 | $\frac{7}{9}$ |
| 2 | 72% |
| 3 | 8 out of 10 |

**Player 3**

$\frac{7}{9} \approx 0.\overline{7}$

$72\% = 0.72$

8 out of 10 = 0.8

**Test Practice**

**7. Multiple Choice** Select the symbol that makes the sentence true.

$\sqrt{27} \underline{\phantom{--}} \dfrac{\sqrt{95}}{2}$

Ⓐ $<$

Ⓑ $>$

Ⓒ $=$

Ⓓ $\leq$

$\sqrt{27} \approx 5.2$

$\dfrac{\sqrt{95}}{2} \approx 4.9$

EMIRATES SCHOOLS
ESTABLISHMENT

# Unit 3

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**Practice..**

Solve each equation. Check your solution. (Examples 1–3)

**1.** $-2a - 9 = 6a + 15$

$$-2a - 9 = 6a + 15$$
$$\underline{-6a \qquad -6a}$$
$$-8a - 9 = 15$$
$$\underline{+9 \quad +9}$$
$$-8a = 24$$
$$\frac{-8a}{-8} = \frac{24}{-8}$$
$$a = -3$$

**2.** $14 + 3n = 5n - 6$

$$14 + 3n = 5n - 6$$
$$\underline{-5n \quad -5n}$$
$$14 - 2n = -6$$
$$\underline{-14 \qquad -14}$$
$$-2n = -20$$
$$\frac{-2n}{-2} = \frac{-20}{-2}$$
$$n = 10$$

**3.** $\frac{1}{2}x - 5 = 10 - \frac{3}{4}x$

$x = 12$

**4.** $\frac{2}{3}y + 1 = \frac{1}{6}y + 8$

$y = 14$

# Solve each equation. Check your solution. (Examples 1–3)

**5.** $5.4p + 13.1 = -2.6p + 3.5$

$$5.4p + 13.1 = -2.6p + 3.5$$
$$\underline{+2.6p \qquad\qquad +2.6p}$$
$$8p + 13.1 = 3.5$$
$$\underline{-13.1 \quad -13.1}$$
$$8p = -9.6$$
$$\frac{8p}{8} = \frac{-9.6}{8}$$
$$p = -1.2$$

**6.** $0.15w + 0.35 = 0.22w - 0.14$

$$0.15w + 0.35 = 0.22w - 0.14$$
$$\underline{-0.22w \qquad\qquad -0.22w}$$
$$-0.07w + 0.35 = -0.14$$
$$\underline{-0.35 \quad -0.35}$$
$$-0.07w = -0.49$$
$$\frac{-0.07w}{-0.07} = \frac{-0.49}{-0.07}$$
$$w = 7$$

**7.** Twelve more than seven times a number equals the number less six. Solve the equation $7x + 12 = x - 6$ to find the number, $x$.

$$7x + 12 = x - 6$$
$$\underline{-x \qquad\qquad -x}$$
$$6x + 12 = -6$$
$$\underline{-12 \quad -12}$$
$$6x = -18$$
$$\frac{6x}{6} = \frac{-18}{6}$$
$$x = -3$$

**Test Practice**

**8. Equation Editor** Solve the equation shown for $x$.

$$3x - 15 = 17 - x$$

$$3x - 15 = 17 - x$$
$$\underline{+ x \qquad\qquad + x}$$
$$4x - 15 = 17$$
$$\underline{+15 \quad +15}$$
$$4x = 32$$
$$\frac{4x}{4} = \frac{32}{4}$$
$$x = 8$$

**1.** Marko has 45 comic books in his collection, and Tamara has 61 comic books. Marko buys 4 new comic books each month and Tamara buys 2 comic books each month. After how many months will Marko and Tamara have the same number of comic books?

Solve the equation $45 + 4m = 61 + 2m$.

| | |
|---|---|
| $45 + 4m = 61 + 2m$ | Write the equation. |
| $\underline{\phantom{45+}-2m \phantom{=61}-2m}$ | Subtraction Property of Equality |
| $45 + 2m = 61$ | Simplify. |
| $\underline{-45 \phantom{+2m}-45}$ | Subtraction Property of Equality |
| $2m = 16$ | Simplify. |
| $\dfrac{2m}{2} = \dfrac{16}{2}$ | Division Property of Equality |
| $m = 8$ | Simplify. |

They will have the same number of comic books after 8 months.

**2.** A fish tank has 150 gallons of water and is being drained at a rate of $\frac{1}{2}$ gallon each second. A second fish tank has 120 gallons of water and is being filled at a rate of $\frac{1}{4}$ gallon each second. After how many seconds will the two fish tanks have the same amount of water?

Fish Tank 1      Fish Tank 2

$$150 - \frac{1}{2}s = 120 + \frac{1}{4}s$$

$$150 - \frac{1}{2}s = 120 + \frac{1}{4}s$$

$$\underline{\phantom{150} -\frac{1}{4}s \phantom{= 120} -\frac{1}{4}s}$$

$$150 - \frac{3}{4}s = 120$$

$$\underline{-150 \phantom{-\frac{3}{4}s}-150}$$

$$-\frac{3}{4}s = -30$$

$$\left(-\frac{4}{3}\right) -\frac{3}{4}s = -30\left(-\frac{4}{3}\right)$$

$$s = 40$$

**3.** Shipping Company A charges $14 plus $2.25 a pound to ship overnight packages. Shipping Company B charges $20 plus $1.50 a pound to ship an overnight package. For what weight is the charge the same for the two companies?

Let $p$ = the number of pounds.

Write an equation that models when they will have the same cost.

Company A    Company B

$$14 + 2.25p = 20 + 1.5p$$

Solve the equation $14 + 2.25p = 20 + 1.5p$.

| | |
|---|---|
| $14 + 2.25p = 20 + 1.5p$ | Write the equation. |
| $\underline{\quad -1.5p \qquad - 1.5p\quad}$ | Subtraction Property of Equality |
| $14 + 0.75p = 20$ | Simplify. |
| $\underline{-14 \qquad\qquad -14}$ | Subtraction Property of Equality |
| $0.75p = 6$ | Simplify. |
| $\dfrac{0.75p}{0.75} = \dfrac{6}{0.75}$ | Division Property of Equality |
| $p = 8$ | Simplify. |

**4.** A bicycle rental company charges a $20 fee plus $5.50 per hour to rent a bicycle. Another bicycle rental company charges a $15 fee plus $6.50 per hour to rent a bicycle. For what number of hours is the cost for the rental the same?

Write an equation that models when they will have the same cost.

Bicycle Company 1    Bicycle Company 2

$$20 + 5.50h = 15 + 6.50h$$

Solve the equation $20 + 5.50h = 15 + 6.50h$.

| | |
|---|---|
| $20 + 5.50h = 15 + 6.50h$ | Write the equation. |
| $\underline{\phantom{xx}-6.50h \phantom{xxxx} -6.50h}$ | Subtraction Property of Equality |
| $20 - h = 15$ | Simplify. |
| $\underline{-20 \phantom{xxxx} -20}$ | Subtraction Property of Equality |
| $-h = -5$ | Simplify. |
| $\dfrac{-h}{-1} = \dfrac{-5}{-1}$ | Division Property of Equality |
| $h = 5$ | Simplify. |

They will have the same cost at 5 hours.

**5. Open Response** Deanna and Lulu are playing games at the arcade. Deanna starts with $15, and the machine she is playing costs $0.75 per game. Lulu starts with $13, and her machine costs $0.50 per game. After how many games will the two friends have the same amount of money remaining? Let $g$ represent the number of games.

Equation: [ ]

Number of Games: [ ]

Deanna        Lulu

$$15 - 0.75g = 13 - 0.50g$$

Solve $15 - 0.75g = 13 - 0.50g$.

| | |
|---|---|
| $15 - 0.75g = 13 - 0.50g$ | Write the equation. |
| $\underline{\phantom{xx}+0.50g \phantom{xxxx} +0.50g}$ | Addition Property of Equality |
| $15 - 0.25g = 13$ | Simplify. |
| $\underline{-15 \phantom{xxxx} -15}$ | Subtraction Property of Equality |
| $-0.25g = -2$ | Simplify. |
| $\dfrac{-0.25g}{-0.25} = \dfrac{-2}{-0.25}$ | Division Property of Equality |
| $g = 8$ | Simplify. |

They will have the same amount of money remaining after 8 games.

# Apply

**6.** Aiden is replacing the tile in a rectangular kitchen. The length of the kitchen is nine feet shorter than three times its width, *w*. The perimeter of the kitchen is six times the width. If tiles cost $1.69 a square foot, what is the total cost to tile the kitchen?

$$3w - 9$$

*w* ⬜ *w*

$$3w - 9$$
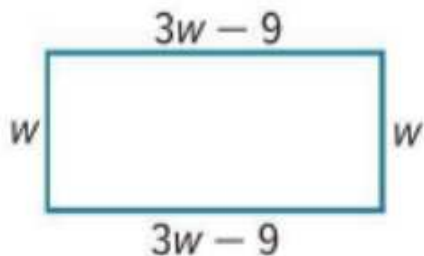
Determine the width of the kitchen.
Write two expressions that represent the perimeter of the kitchen.
Perimeter of the kitchen is six times the width: $P = 6w$
Perimeter $= w + (3w - 9) + w + (3w - 9)$ or $8w - 18$
The expressions are equivalent. So, set them equal to each other and solve for *w*.

Solve $6w = 8w - 18$.

| | |
|---|---|
| $6w = 8w - 18$ | Write the equation. |
| $\underline{-8w = -8w}$ | Subtraction Property of Equality |
| $-2w = -18$ | Simplify. |
| $\dfrac{-2w}{-2} = \dfrac{-18}{-2}$ | Division Property of Equality |
| $w = 9$ | Simplify. |

Find the area of the kitchen.

| | |
|---|---|
| $A = \text{length} \times \text{width}$ | Write the equation. |
| $= (3w - 9) \times w$ | Replace length with $(3w - 9)$ and width with *w*. |
| $= (3(9) - 9) \times 9$ | Replace each *w* with 9. |
| $= 162$ | Simplify. |

The area is 162 square feet.

Multiply the area by the cost per square foot to find the total cost.
$162 \times \$1.69 = \$273.78$

**7.** Hailey is putting up a fence in the shape of an isosceles triangle in her backyard. The fence has side lengths as shown, where *x* represents the number of feet in each fence section. The perimeter of the fence can be covered using 8 total fence sections represented by the expression 8*x*. If fencing costs $6.50 a foot, what would be the total cost of the fence?

$(2x + 4)$ ft, $(3x + 7)$ ft, $(2x + 4)$ ft
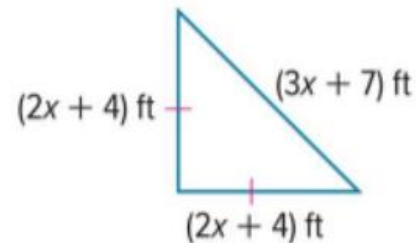
First determine the value of *x*.
Write two expressions that represent the perimeter of the backyard.
$P = 8x$
$P = 2x + 4 + 3x + 7 + 2x + 4$ or $7x + 15$
The expressions are equivalent. So, set them equal to each other and solve for *x*.

Solve $8x = 7x + 15$.

| | |
|---|---|
| $8x = 7x + 15$ | Write the equation. |
| $\underline{-7x = -7x}$ | Subtraction Property of Equality |
| $x = 15$ | Simplify. |

Find the perimeter.

| | |
|---|---|
| $P = 8x$ | Write the equation. |
| $= 8(15)$ | Replace length with *x* width 18. |
| $= 120$ | Simplify. |

The perimeter is 120 feet.

To find the total cost, multiply the perimeter by the cost per foot.
$120 \times \$6.50 = \$780$

**Solve each equation. Check your solution.**

**1.** $-g + 2(3 + g) = -4(g + 1)$

$$-g + 2(3 + g) = -4(g + 1)$$
$$-g + 6 + 2g = -4g - 4$$
$$g + 6 = -4g - 4$$
$$\underline{+4g \qquad +4g}$$
$$5g + 6 = -4$$
$$\underline{-6 \quad -6}$$
$$5g = -10$$
$$\frac{5g}{5} = \frac{-10}{5}$$
$$\boxed{g = -2}$$

**2.** $-8 - x = -3(2x - 4) + 3x$

$$-8 - x = -3(2x - 4) + 3x$$
$$-8 - x = -6x + 12 + 3x$$
$$-8 - x = -3x + 12$$
$$\underline{+3x \quad +3x}$$
$$-8 + 2x = 12$$
$$\underline{+8 \qquad +8}$$
$$2x = 20$$
$$\frac{2x}{2} = \frac{20}{2}$$
$$\boxed{x = 10}$$

**3.** $0.6(4 - 2x) = 20.5 - (3x + 10)$

$$0.6(4 - 2x) = 20.5 - (3x + 10)$$
$$2.4 - 1.2x = 20.5 - 3x - 10$$
$$2.4 - 1.2x = 10.5 - 3x$$
$$\underline{+3x \qquad\qquad +3x}$$
$$2.4 + 1.8x = 10.5$$
$$\underline{-2.4 \qquad\quad -2.4}$$
$$1.8x = 8.1$$
$$\frac{1.8x}{1.8} = \frac{8.1}{8.1}$$
$$\boxed{x = 4.5}$$

**4.** $12 - (4y + 8) = 0.5(8y - 16)$

$$12 - (4y + 8) = 0.5(8y - 16)$$
$$12 - 4y - 8 = 4y - 8$$
$$4 - 4y = 4y - 8$$
$$\underline{-4y \quad -4y}$$
$$4 + -8y = -8$$
$$\underline{-4 \qquad\qquad -4}$$
$$-8y = -12$$
$$\frac{-8y}{-8} = \frac{-12}{-8}$$
$$\boxed{y = 1.5} = \frac{3}{2}$$

**Solve each equation. Check your solution.**

**5.** $\frac{1}{2}(-4 + 6n) = \frac{1}{3}n + \frac{2}{3}(n + 9)$

$$\frac{1}{2}(-4 + 6n) = \frac{1}{3}n + \frac{2}{3}(n + 9)$$

$$-2 + 3n = \frac{2}{3}n + \frac{2}{3}n + 6$$

$$-2 + 3n = n + 6$$

$$\underline{\quad -n \quad -n \quad}$$

$$-2 + 2n = 6$$

$$\underline{+2 \qquad +2}$$

$$2n = 8$$

$$\frac{2n}{2} = \frac{8}{2}$$

$$\boxed{n = 4}$$

**6.** $\frac{1}{5}(5x - 5) + 3x = -9\left(\frac{1}{3}x + 4\right)$

$$\frac{1}{5}(5x - 5) + 3x = -9$$

$$x - 1 + 3x = -3x - 36$$

$$-1 + 4x = -3x - 36$$

$$\underline{\quad +3x \qquad +3x}$$

$$-1 + 7x = -36$$

$$\underline{+1 \qquad\qquad +1}$$

$$7x = -35$$

$$\frac{7x}{7} = \boxed{\frac{-35}{7}}$$

$$\boxed{x = -5}$$

**7. Equation Editor** Solve the equation shown for $q$.

$$2\left(\frac{1}{2}q + 1\right) = -3(2q - 1) + 8q + 4$$

$$2\left(\frac{1}{2}q + 1\right) = -3(2q - 1) + 8q + 4$$

$$q + 2 = -6q + 3 + 8q + 4$$

$$q + 2 = 2q + 7$$

$$\underline{-2q \qquad -2q}$$

$$-q + 2 = 7$$

$$\underline{\quad -2 \quad -2}$$

$$-q = 5$$

$$\frac{-q}{-1} = \frac{5}{-1}$$

$$\boxed{q = -5}$$

**1.** Mr. Reed is drawing a blueprint of a rectangular patio. The width of the patio is $40\frac{3}{4}$ feet shorter than twice its length. The perimeter of the patio is $86\frac{1}{2}$ feet. What is the length of the patio?

Let $\ell$ represent the length in feet of the garden.

The width is $40\frac{3}{4}$ feet shorter than twice its length: $w = 2\ell - 40\frac{3}{4}$

Write an equation that models the perimeter.

$P = 2\ell + 2w$      Write the equation.

$86\frac{1}{2} = 2\ell + 2\left(2\ell - 40\frac{3}{4}\right)$      Replace $P$ with $86\frac{1}{2}$ and $w$ with $2\ell - 40\frac{3}{4}$.

Solve the equation $86\frac{1}{2} = 2\ell + 2\left(2\ell - 40\frac{3}{4}\right)$.

$86\frac{1}{2} = 2\ell + 2\left(2\ell - 40\frac{3}{4}\right)$      Write the equation.

$86\frac{1}{2} = 2\ell + 4\ell - 81\frac{1}{2}$      Distributive Property

$86\frac{1}{2} = 6\ell - 81\frac{1}{2}$      Combine like terms.

$\underline{+ 81\frac{1}{2} \qquad + 81\frac{1}{2}}$      Addition Property of Equality

$168 = 6\ell$      Simplify.

$28 = \ell$      Division Property of Equality

The length is 28 feet.

**2.** The Yearbook Club is going to an amusement park, and each of their 12 members will pay for admission and will also help pay for parking. The Robotics Club is going to a waterpark, and each of their 14 members will pay for admission and will also purchase a meal ticket. Admission to the amusement park is 1.5 times that of the waterpark's admission, as shown in the table. If the total cost is the same at both the amusement park and the waterpark, what is the admission per student to the waterpark?

| Amusement Park | Waterpark |
|---|---|
| Admission: $1.5x per student | Admission: $x per student |
| Parking: $2 per student | Meal Ticket: $10.50 per student |

Write an equation.

Let $x$ = the cost of admission to the waterpark.

The cost of the amusement park: $12(1.5x + 2)$

The cost of the waterpark: $14(x + 10.50)$

Because the costs are equal set the expressions equal to each other: $12(1.5x + 2) = 14(x + 10.5)$

Solve the equation $12(1.5x + 2) = 14(x + 10.5)$.

$$12(1.5x + 2) = 14(x + 10.5)$$  Write the equation.

$$18x + 24 = 14x + 147$$  Distributive Property

$$\underline{-14x \qquad -14x}$$  Subtraction Property of Equality

$$4x + 24 = 147$$  Simplify.

$$\underline{-24 \quad -24}$$  Subtraction Property of Equality

$$4x = 123$$  Simplify.

$$\frac{4x}{4} = \frac{123}{4}$$  Division Property of Equality

$$x = 30.75$$  Simplify.

The cost of admission to the waterpark is $30.75.

3. **Open Response** Arjun purchased 5 tickets to a play, each with the same price. He was also charged an online service fee of $3.50 per ticket. Emilia purchased 3 tickets to the same play and paid twice as much for her tickets as Arjun. Emilia was also charged a service fee of $2.75 per ticket. If they spent the same amount, what is the cost of each of the tickets Arjun purchased? Let $t$ represent the cost of each of Arjun's tickets.

Equation:

Cost of a Ticket:

4. Four siblings have a dog walking business. The table shows the hours worked by each sibling. Each sibling earns $25.50 per hour and the total number of hours worked is represented by $10h + 15$, where $h$ represents the number of hours Michael worked. What was the total amount the siblings earned?

| Sibling | Hours Worked |
|---------|-------------|
| Martin | $2.5h + 3$ |
| Emilio | $4(h - 2)$ |
| Michael | $h$ |
| Mario | 31 |

---

Write an equation.
Let $t$ represent the cost of each of Arjun's tickets.
Arjun's ticket cost: $5(t + 3.50)$
Emilia's ticket cost: $3(2t + 2.75)$
Because the costs are equal set the expressions equal to each other: $5(t + 3.50) = 3(2t + 2.75)$

Solve the equation $5(t + 3.50) = 3(2t + 2.75)$.

| | |
|---|---|
| $5(t + 3.50) = 3(2t + 2.75)$ | Write the equation. |
| $5t + 17.50 = 6t + 8.25$ | Distributive Property |
| $\underline{-6t \qquad\qquad -6t}$ | Subtraction Property of Equality |
| $-t + 17.50 = 8.25$ | Simplify. |
| $\underline{-17.50 \quad -17.50}$ | Subtraction Property of Equality |
| $-t = -9.25$ | Simplify. |
| $\dfrac{-t}{-1} = \dfrac{-9.25}{-1}$ | Division Property of Equality |
| $t = 9.25$ | Simplify. |

The cost of the ticket was $9.25.

---

Solve the equation $10h + 15 = 7.5h + 26$.

| | |
|---|---|
| $10h + 15 = 7.5h + 26$ | Write the equation. |
| $\underline{-7.5h \qquad -7.5h}$ | Subtraction Property of Equality |
| $2.5h + 15 = 26$ | Simplify. |
| $\underline{-15 \; -15}$ | Subtraction Property of Equality |
| $2.5h = 11$ | Simplify. |
| $\dfrac{2.5h}{2.5} = \dfrac{11}{2.5}$ | Division Property of Equality |
| $h = 4.4$ | Simplify. |

Find the total hours the siblings worked.

| | |
|---|---|
| $10h + 15$ | Write the expression. |
| $10(4.4) + 15$ | Replace $h$ with 4.4. |
| $44 + 15$ or $59$ | Simplify. |

They worked 59 hours.

Find the total earnings.
$59 \times \$25.50 = \$1{,}504.50$

**5. Create** Write a real-world problem that can be solved using a multi-step equation. Then write and solve an equation for your problem.

Solve the equation $4x + 15(x - 2.25) = 18.50$.

$4x + 15(x - 2.25) = 18.50$.

$4x + 15(x - 2.25) = 18.50$

$4x + 15x - 33.75 = 18.50$

$19x - 33.75 = 18.50$

$19x = 52.25$

$x = 2.75$

Each snack costs $2.75.

**6.** (MP) **Persevere with Problems** Elijah put $2x + 3$ dollars in the bank the first week. The following week he doubled the first week's savings and put that amount in the bank. The next week, he doubled what was in the bank and put that amount in the bank. He now has $477 in the bank. Write and solve an equation to find how much money he put in the bank the first week.

Write an equation that represents how much he put in the bank.

$(2x + 3) + 2(2x + 3) + 2[(2x + 3) + 2(2x + 3)] = 477$ or $18x + 27 = 477$

Solve $18x + 27 = 477$.

$18x + 27 = 477$

$18x + 27 - 27 = 477 - 27$

$18x = 420$

$x = 25$

Replace $x$ with 25 in $2x + 3$ to find how much money he put in the bank the first week.

$2(25) + 3 = 53$

He put in $53 the first week.

**Practice..** Solve each equation. Determine whether the equation has one solution, no solution, or infinitely many solutions. (Examples 1 and 2)

**1.** $4(x - 8) + 12 = 2(2x - 9)$

$4(x - 8) + 12 = 2(2x - 9)$
$4x - 32 + 12 = 4x - 18$
$4x - 20 = 4x - 18$
$\underline{-4x \qquad\quad -4x}$
$20 = -18$

no solution

**2.** $3(2k - 5) = 6(k - 4) + 9$

$3(2k - 5) = 6(k - 4) + 9$
$6k - 15 = 6k - 24 + 9$
$6k - 15 = 6k - 15$
$\underline{-6k \qquad\quad -6k}$
$-15 = -15$ \qquad infinitely many solutions

**3.** $-4y - 3 = \frac{1}{3}(12y - 9) - 8y$

$-4y - 3 = \frac{1}{3}(12y - 9) - 8y$

$-4y - 3 = 4y - 3 - 8y$
$-4y - 3 = -4y - 3$
$\underline{+4y \qquad\quad +4y}$
$-3 = -3$

infinitely many solutions.

**4.** $6(3 - 5w) = 5(4 - 2w) - 20w$

$6(3 - 5w) = 5(4 - 2w) - 20w$
$18 - 30w = 20 - 10w - 20w$
$18 - 30w = 20 - 30w$
$\underline{+30w \qquad\quad + 30w}$
$18 = 20$

no solution

**5.** $2x - 7(x + 10) = \boxed{\phantom{x}} x - \boxed{\phantom{x}}$

**6.** $12x - x + 8 + 3x = \boxed{\phantom{x}} x + \boxed{\phantom{x}}$

$2x - 7(x + 10) = \underline{\quad} x - \underline{\quad}$
$2 \quad x - 7x - 70 = \underline{\quad} x - \underline{\quad}$
$-5x - 70 = \underline{\quad} x - \underline{\quad}$
$-5x - 70 = -5x - 70$

*ANSWER:*

$2x - 7(x + 10) = -5x - 70$

$12x - x + 8 + 3x = \underline{\quad} x + \underline{\quad}$
$14x + 8 = \underline{\quad} x + \underline{\quad}$
$14x + 8 = 14x + 8$

*ANSWER:*

$12x - x + 8 + 3x = 14x + 8$

**Complete each equation so that it has no solution.** (Example 4)

**7.** $-15x + 4x + 2 - x = \boxed{\phantom{x}}\, x + \boxed{\phantom{x}}$

**8.** $9(x - 4) - 5x = \boxed{\phantom{x}}\, x - \boxed{\phantom{x}}$

---

*SOLUTION:*

$-15x + 4x + 2 - x = \underline{\phantom{x}}\, x + \underline{\phantom{x}}$

$\qquad -12x + 2 = \underline{\phantom{x}}\, x + \underline{\phantom{x}}$

$\qquad \boxed{-12x} \boxed{+ 2} = \boxed{-12x} \boxed{+ 6}$

be different.

---

$9(x - 4) - 5x = \underline{\phantom{xx}}\, x - \underline{\phantom{xx}}$

*SOLUTION:*

$9(x - 4) - 5x = \underline{\phantom{xx}}\, x - \underline{\phantom{xx}}$

$9x - 36 - 5x = \underline{\phantom{xx}}\, x - \underline{\phantom{xx}}$

$\qquad 4x - 36 = \underline{\phantom{xx}}\, x - \underline{\phantom{xx}}$

$\qquad \boxed{4x} \boxed{- 36} = \boxed{4x} \boxed{- 10}$

**9. Multiple Choice** Which of the following explains why $\frac{2}{3}(x + 3) = \frac{2}{3}(x - 6)$ has no solution?

(A) The coefficients are different, and the constants are different.

(B) The coefficients are the same, and the constants are the same.

(C) The coefficients are different, and the constants are the same.

(D) The coefficients are the same, and the constants are different.

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$\frac{2}{3}x + 2 = \frac{2}{3}x - 4$

**1.** The graph shows the amount of book sales over several days. Find and interpret the slope. Then find the unit rate and compare it to the slope. (Example 1)

**Book Sales**
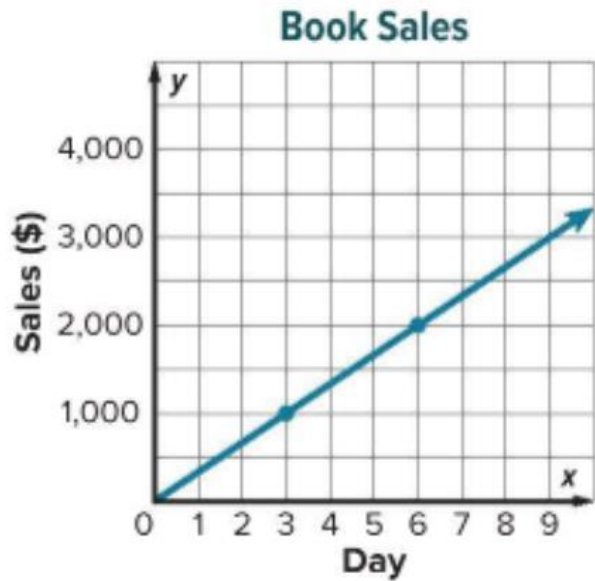


$$\frac{\text{change in sales}}{\text{change in days}} = \frac{\$(2{,}000 - 1{,}000)}{(6-3) \text{ days}}$$
$$= \frac{\$1{,}000}{3 \text{ days}}$$
$$\approx \frac{\$1{,}000}{1 \text{ day}} \text{ or about } \$333.33 \text{ per day}$$

**2.** The cost $y$ of renting a snowmobile for $x$ hours is a proportional relationship. This can be represented by the equation $y = 33.75x$. Graph the equation. Then find and interpret the slope. (Example 2)

→ Slope = 33.75

unite rate = $\dfrac{y\ 33.75}{x\ 1}$
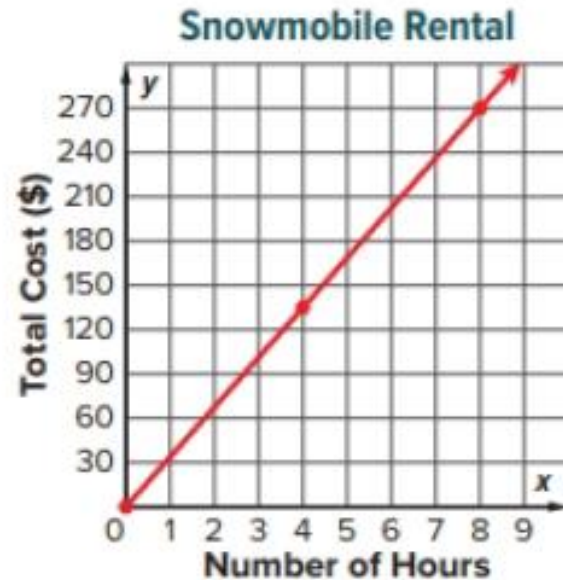
**Snowmobile Rental**



| Hours, $x$ | $y = 33.75x$ | Cost ($) |
|---|---|---|
| 0 | $y = 33.75(0)$ | 0 |
| 4 | $y = 33.75(4)$ | 135 |
| 8 | $y = 33.75(8)$ | 270 |

The slope of the line is $\dfrac{33.75}{1}$ or 33.75.

This means that it costs $33.75 per hour to rent the snowmobile.

**3.** By the end of its fourth week, a movie had grossed $9.2 million. Assume the revenue y in millions of dollars is proportional to the week x. Graph this relationship on the coordinate plane. Then find and interpret the slope. (Example 3)

**Movie Sales**
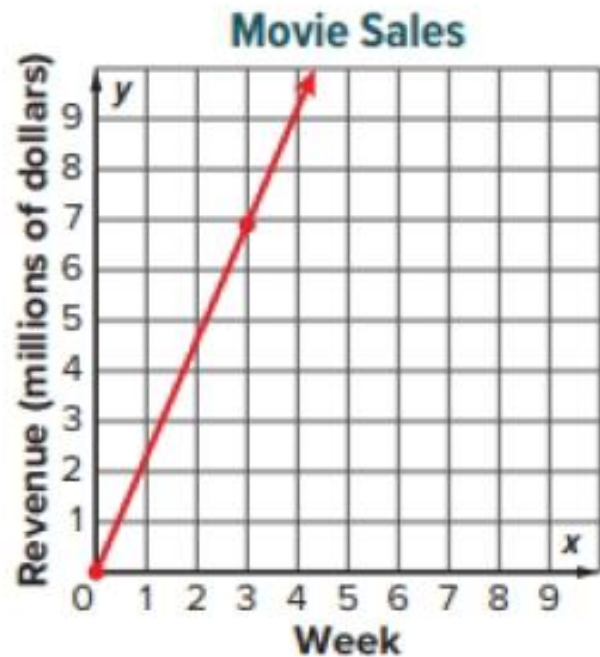


Graph the relationship. Find the unit rate.

$9.2 million in 4 weeks $= \dfrac{9.2 \text{ million}}{4 \text{ weeks}}$  Write the rate as a fraction.

$= \dfrac{2.3 \text{ million}}{1 \text{ week}}$  Simplify.

The unit rate is 2.3 million per week.

Make a table of values to find the revenue for 0 and 3 weeks.

| Weeks, x | Revenue (in millions of dollars) |
|---|---|
| 0 | 0 |
| 3 | 6.9 |

The slope of the line is $\dfrac{2.3}{1}$ or 2.3. This means that the movie grossed $2.3 million each week

4. The amount of power $y$ solar panel A can produce with an area of $x$ square meters can be represented by the equation $y = 1{,}020x$. The amount of power a solar panel B can produce is shown on the graph. Which solar panel can produce more power? Explain. **(Example 4)**
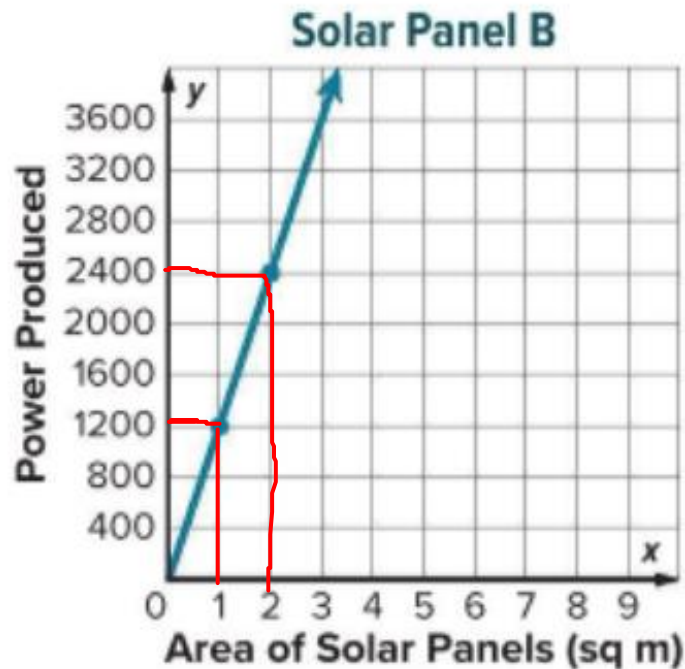
**Solar Panel B**



Find the slope or unit rate for solar panel A from the equation.

$y = 1{,}020x$          $y = mx$, $m =$ slope or unit rate

$m = 1{,}020$          The coefficient of $x$.

The unit rate for solar panel A is 1,020 power produced per square meters.

Find the constant rate of change for solar panel B from the graph.
Choose any two points on the line, such as (1, 1,200) and (2, 2,400).

$$\frac{(2{,}400 - 1{,}200)}{(2 - 1)}$$          Find the rate of change between the points.

$$= \frac{1{,}200}{1}$$          Simplify.

The unit rate for solar panel B is 1,200 power produced per square meters.

Because $1{,}200 > 1{,}020$, panel B produces more power.

Craig

**5. Open Response** The distance $y$ that Craig biked on $x$ day trips is shown in the table. Rei biked 23.6 miles per day. Assume that the number of miles is proportional to the number of days. Who biked the lower number of miles each day? Explain. **(Example 5)**

| Number of Day Trips | Distance (mi) |
| --- | --- |
| 2 | 43.6 |
| 3 | 65.4 |
| 4 | 87.2 |

Find the unit rate for Craig. Use the data values (2, 43.6) and (3, 65.4) from the table.

$$\frac{\text{change in miles}}{\text{change in days}} = \frac{(65.4 - 43.6) \text{ miles}}{(3 - 2) \text{ days}} \qquad \text{Find the rate of change.}$$

$$= \frac{21.8 \text{ miles}}{1 \text{ day}} \text{ or } 21.8 \text{ miles per day} \qquad \text{Simplify.}$$

The unit rate of Craig's day trips is 21.8 miles per day.

Rei bikes 23.6 miles per day.

Because Rei biked 23.6 miles per day, and 23.6 > 21.8, Craig biked the lower number of miles each day.

# Apply

**6.** Nadia is comparing costs for two brands of garden compost. For Brand A, the cost $y$ for $x$ bags is shown in the table. For Brand B, the cost $y$ can be represented by the equation $y = 1.99x$, where $x$ represents the number of bags. Which brand costs less for 6 bags of compost? How much less?

| Number of Bags, $x$ | Total Cost ($), $y$ |
|---|---|
| 3 | 8.01 |
| 5 | 13.35 |

Find the unit cost for Brand A. Use the data values from the table.

$$\frac{\text{change in cost}}{\text{change in bags}} = \frac{\$(13.35 - 8.01)}{(5-3) \text{ bags}}$$    Find the rate of change.

$$= \frac{\$5.34}{2 \text{ bags}}$$    Simplify.

$$= \frac{\$2.67}{1 \text{ bag}} \text{ or } \$2.67 \text{ per bag}$$    Simplify.

Brand A costs $2.67 per bag.

Find the unit cost for Brand B. Use the equation.

$y = 1.99x$          $y = mx$, $m = $ slope or unit rate

$m = 1.99$          The coefficient of x.

Brand B costs $1.99 per bag.

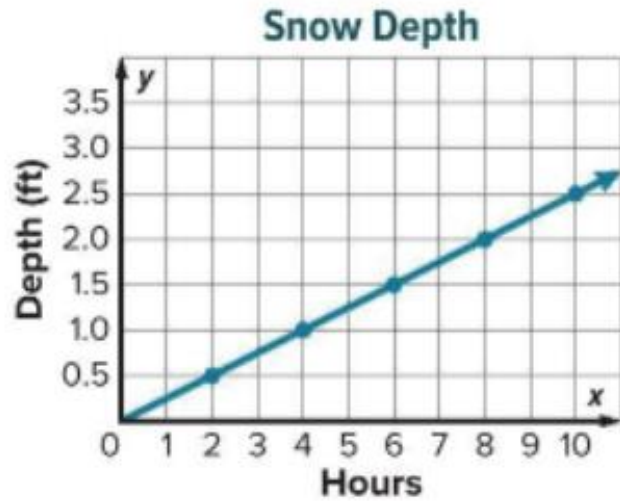Find the costs for 6 bags for each brand.

Brand A: $6 \times \$2.67 = \$16.02$

Brand B: $6 \times \$1.99 = \$11.94$

Because $16.02 > $11.94, brand B costs less. Brand B costs $16.02 - $11.94 or $4.08 less.

**1.** The graph shows the depth in feet of snow after each two-hour period during a snowstorm. Find the slope of the line. **(Example 1)**

**Snow Depth**



Select two points from the graph. Sample points (4, 1) and (8, 2).

$$\text{slope} = \frac{\text{rise}}{\text{run}} \qquad \text{Definition of slope}$$

$$= \frac{1}{4} \text{ or } 0.25 \qquad \text{rise} = 1, \text{run} = 4$$

ANSWER:

$\frac{1}{4}$ or 0.25

**2.** The graph shows the amount of money left after buying video games. Find the slope of the line. **(Example 2)**

**Remaining Money**



Select two points from the graph. Sample points (2, 80) and (4, 40).

$$\text{slope} = \frac{\text{rise}}{\text{run}} \qquad \text{Definition of slope}$$

$$= \frac{-40}{2} \qquad \text{rise} = -40, \text{run} = 2$$

$$= \frac{-20}{1} \qquad \text{Simplify the ratio.}$$

ANSWER:

−20

**3.** The points given in the table lie on a line. Find the slope of the line. (Example 3)

| x | −1 | 2 | 5 | 8 |
|---|----|----|----|----|
| y | 3 | −1 | −5 | −9 |

$$\text{slope} = \frac{\text{change in } y}{\text{change in } x} \qquad \text{Definition of slope}$$

$$= \frac{(-1-3)}{(2-(-1))} \qquad \text{Use the points } (-1, 3) \text{ and } (2, -1).$$

$$= -\frac{4}{3} \text{ or } -1\frac{1}{3} \text{ or } -1.\overline{3} \qquad \text{Simplify.}$$

**Find the slope of the line that passes through each pair of points.** (Examples 4–6)

**4.** $M(3, 5)$, $N(2, 6)$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$= \frac{6-5}{2-3}$$

$$= \frac{1}{-1} \text{ or } -1$$

**5.** $G(-3, 2)$, $H(7, 2)$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$= \frac{2-2}{7-(-3)}$$

$$= \frac{0}{-10} \text{ or } 0$$

*ANSWER:*
0

**6.** $E(6, 8)$, $F(6, -2)$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$= \frac{-2-8}{6-6}$$

$$= \frac{-10}{0}$$

*ANSWER:*
undefined

7. **Multiple Choice** The points given in each table lie on lines. Which table, when graphed, would show a negative slope?

(A)

| x | −2 | 3 | 8 | 13 |
|---|---|---|---|---|
| y | −2 | −1 | 0 | 1 |

(C)

| x | 3 | 5 | 6 | 8 |
|---|---|---|---|---|
| y | 8 | 0 | −4 | −12 |

(B)

| x | −1 | 1 | 3 | 5 |
|---|---|---|---|---|
| y | −2 | 0 | 2 | 4 |

(D)

| x | −13 | −9 | −5 | −1 |
|---|---|---|---|---|
| y | −4 | −2 | 0 | 2 |

**1.** The graph of line *m* is shown. Use the similar slope triangles to compare the slope of segment *RT* and *TV*. (Example 1)
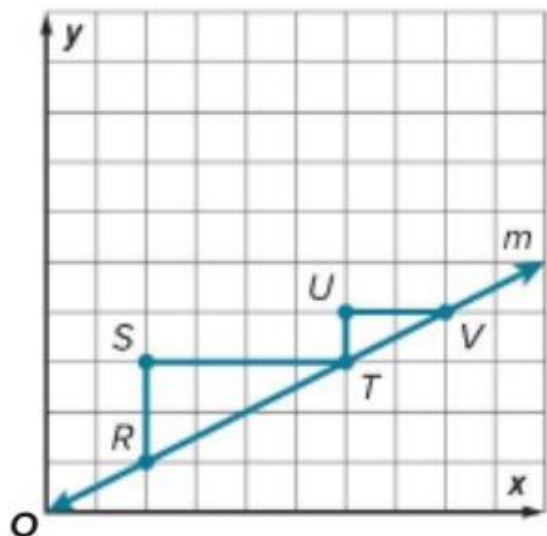


Find the slope of segment *RT*. Use triangle *RST* to find the ratio of the rise to the run.

$$\frac{RS}{ST} = \frac{2}{4} \qquad \text{rise} = 2, \text{run} = 4$$

$$= \frac{1}{2} \qquad \text{Simplify.}$$

The slope of segment *RT* is $\frac{1}{2}$ or 0.5.

Find the slope of segment *TV*. Use triangle *TUV* to find the ratio of the rise to the run.
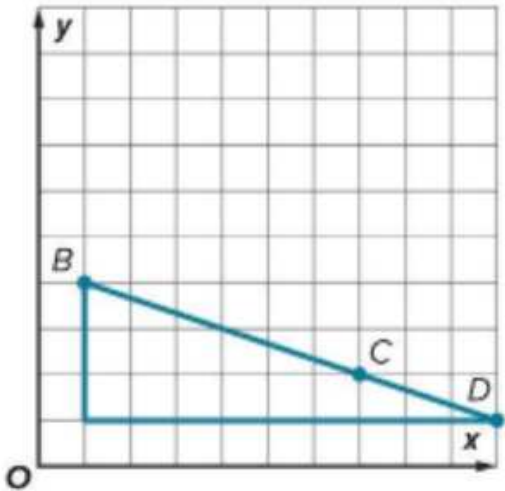
$$\frac{UT}{UV} = \frac{1}{2} \qquad \text{rise} = 1, \text{run} = 2$$

The slope of segment *TV* is $\frac{1}{2}$ or 0.5.

Because $\frac{1}{2} = \frac{1}{2}$ the slopes of each segment are equal.
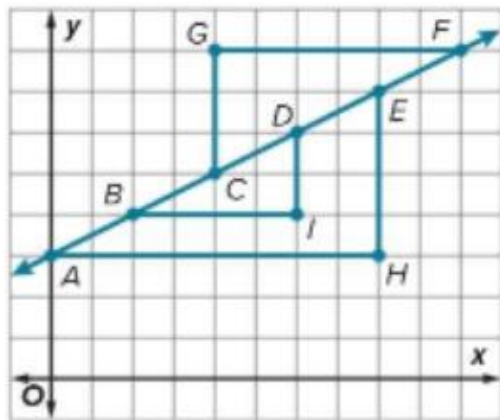
2. The plans for a zipline are shown. Use two points to determine the slope of the zipline. Then verify that the slope is the same by choosing a different set of points. (Example 2)



The slope of the zipline is $-\dfrac{1}{3}$ or $-0.\overline{3}$.

**3.** Name the slope triangles shown in the graph. What is the slope of the line?

The triangles are $AHE$, $BID$, and $CGF$. Find the slope using all 3 slope triangles.

Find the slope of segment $CF$. Use triangle $CGF$ to find the ratio of the rise to the run.

$$\frac{CG}{GF} = \frac{3}{6} \qquad \text{rise} = 3, \text{run} = 6$$

$$= \frac{1}{2} \qquad \text{Simplify.}$$

The slope of segment $CG$ is $\frac{1}{2}$ or 0.5.

Verify using a different triangle. Use segment $AE$. Use triangle $AHE$ to find the ratio of the rise to the run.

$$\frac{EH}{AH} = \frac{4}{8} \qquad \text{rise} = 4, \text{run} = 8$$

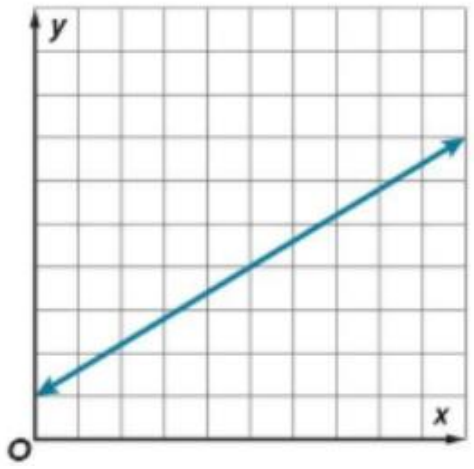$$= \frac{1}{2} \qquad \text{Simplify.}$$

The slope of segment $AE$ is $\frac{1}{2}$ or 0.5.

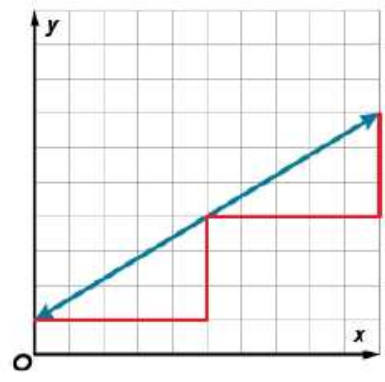Verify using a different triangle. Use segment $BD$. Use triangle $BID$ to find the ratio of the rise to the run.

$$\frac{DI}{BI} = \frac{2}{4} \qquad \text{rise} = 2, \text{run} = 4$$

$$= \frac{1}{2} \qquad \text{Simplify.}$$

The slope of segment $BD$ is $\frac{1}{2}$ or 0.5.

**4.** Draw two slope triangles on the line. Determine the slope of the line.



Draw two slope triangles. Sample slope triangles shown.



Find the slope. Use the first slope triangle.

slope = $\dfrac{\text{rise}}{\text{run}}$      Definition of slope

     = $\dfrac{3}{5}$      rise = 3, run = 5

Verify the slope using the second slope triangle.

slope = $\dfrac{\text{rise}}{\text{run}}$      Definition of slope

     = $\dfrac{3}{5}$      rise = 3, run = 5

## Test Practice

**5. Multiselect** The graph shows similar slope triangles on a line. Select all of the statements that are true.



☐ The slope of the line is negative.

☐ The slopes of each triangle are the same because they lie on the same line.

☐ Triangle *CDE* has a greater slope because the triangle is larger.

☐ The slope of each triangle is $\dfrac{2}{3}$.

☐ The slope of the line is positive.
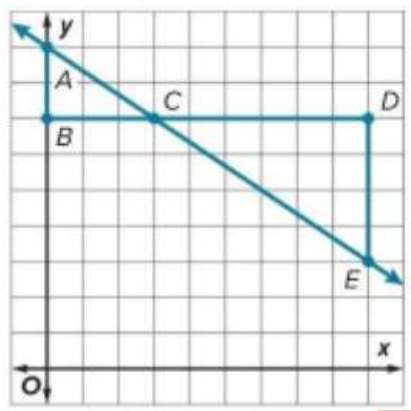
The slope of the line is negative.
The slopes of each triangle are the same because they lie on the same line.

**1.** The cost $y$ of movie tickets varies directly with the number of tickets $x$ as shown in the graph. Write a direct variation equation to represent this relationship. Then identify the constant of variation and interpret its meaning. **(Example 1)**

**Movie Tickets**
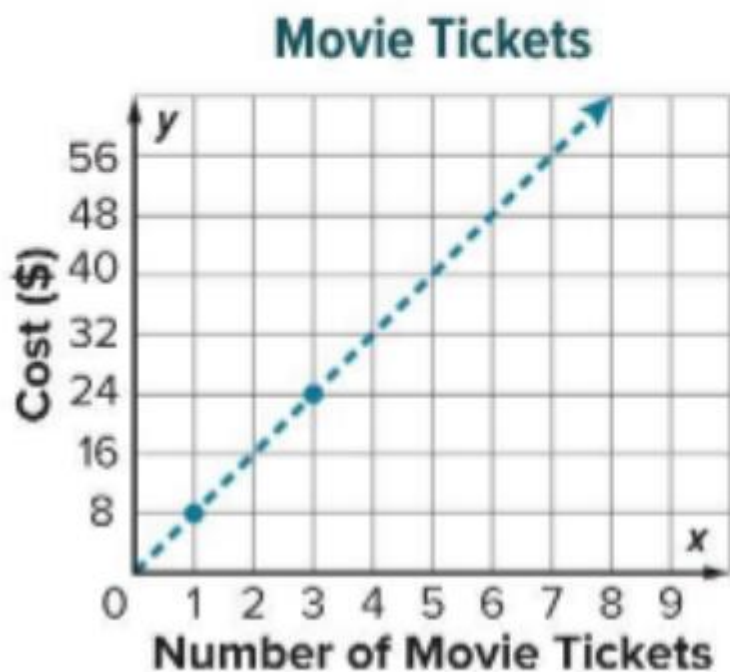


Write a direct variation equation.

Find the slope $m$ using the graph.

$$\text{slope} = \frac{\text{rise}}{\text{run}} \qquad \text{Definition of slope}$$

$$\text{slope} = \frac{24 - 8}{3 - 1} \qquad \text{Use the points } (1, 8) \text{ and } (3, 24) \text{ from the line.}$$

$$\text{slope} = \frac{16}{2} \qquad \text{Simplify.}$$
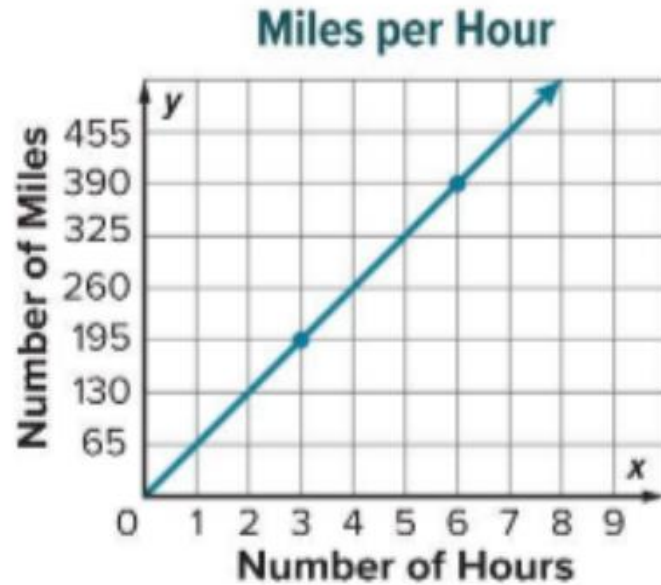
$$\text{Slope} = \frac{8}{1} \text{ or } 8 \qquad \text{Simplify.}$$

Use the value of $m$ to write the equation.

$$y = mx \qquad \text{Direct variation equation}$$

$$y = 8x \qquad \text{Replace } m \text{ with 8.}$$

**2.** The number of miles $y$ varies directly with the number of hours $x$ as shown in the graph. Write a direct variation equation to represent this relationship. Then identify the constant of variation and interpret its meaning. **(Example 1)**

**Miles per Hour**



Number of Miles: 455, 390, 325, 260, 195, 130, 65
Number of Hours: 0 1 2 3 4 5 6 7 8 9

Write a direct variation equation.
Find the slope $m$ using the graph.

$$\text{slope} = \frac{\text{rise}}{\text{run}}$$      Definition of slope

$$\text{slope} = \frac{390 - 195}{6 - 3}$$      Use the points (3, 195) and (6, 390) from the line.

$$\text{slope} = \frac{195}{3}$$      Simplify.

$$\text{Slope} = \frac{65}{1} \text{ or } 65$$      Simplify.

Use the value of $m$ to write the equation.

$y = mx$      Direct variation equation

$y = 65x$      Replace $m$ with 65.

**3.** The cost of paper varies directly with the number of reams bought. Suppose two reams cost $5.10. Write a direct variation equation to represent this relationship. Then identify the constant of variation and interpret its meaning. (Example 2)

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Write a direct variation equation.

Find the unit rate $m$.

$$\$5.10 \text{ for 2 reams} = \frac{\$5.10}{2 \text{ reams}} \qquad \text{Write the rate as a fraction.}$$

$$= \frac{\$2.55}{1 \text{ ream}} \qquad \text{Simplify.}$$

The unit rate is $2.55 per ream.

Use the value of $m$ to write the equation.

$$y = mx \qquad\qquad \text{Direct variation equation}$$
$$y = 2.55x \qquad\qquad \text{Replace } m \text{ with 2.55.}$$

The constant of variation is equal to the slope of the graph. So, the constant of variation is 2.55. This means that the cost per ream is $2.55.

**4.** The amount of flour needed for a recipe varies directly with the number of servings planned. Three servings require $4\frac{1}{2}$ cups of flour. Write a direct variation equation to represent this relationship. Then identify the constant of variation and interpret its meaning. **(Example 2)**

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Write a direct variation equation.
Find the unit rate $m$.

$$\text{cups for 3 servings} = \frac{4\frac{1}{2}\ \text{cups}}{3\ \text{servings}} \qquad \text{Write the rate as a fraction.}$$

$$= \frac{1\frac{1}{2}\ \text{cups}}{1\ \text{serving}} \qquad \text{Simplify.}$$

The unit rate is 1.5 or $1\frac{1}{2}$ cups per serving.

Use the value of $m$ to write the equation.

$y = mx$             Direct variation equation
$y = 1.5x$         Replace $m$ with 1.5.

The constant of variation is equal to the slope of the graph. So, the constant of variation is 1.5. This means that each serving requires $1\frac{1}{2}$ cups of flour.

5. **Open Response** The distance a bus travels varies directly with time as shown in the table. Write a direct variation equation to represent this relationship. Then identify the constant of variation and interpret its meaning. **(Example 3)**

| Time (h), x | Distance (mi), y |
|---|---|
| 1.5 | 93.75 |
| 3 | 187.5 |
| 4.5 | 281.25 |
| 6 | 375 |

Write a direct variation equation.
Find the slope $m$ using the graph. Find the changes in the x- and y- values.

$$\text{slope} = \frac{\text{rise}}{\text{run}}$$       Definition of slope

$$\text{slope} = \frac{375 - 187.5}{6 - 3}$$       Use the points (3, 187.5) and (6, 375).

$$\text{slope} = \frac{187.5}{3}$$       Simplify.

$$\text{Slope} = \frac{62.5}{1} \text{ or } 62.5$$       Simplify.

Use the value of $m$ to write the equation.
$y = mx$       Direct variation equation
$y = 62.5x$       Replace $m$ with 6.25.

The constant of variation is equal to the slope of the graph. The constant of variation is 62.5. This means that the bus travels 62.5 miles per hour.

*ANSWER:*
$y = 62.5x$; The constant of variation is 62.5. This means that the bus travels 62.5 miles per hour.