

Grade 10 Academic Math (MPM2D0)  
Pre-Requisite Algebra Skills  
Summer Package

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## ORDER OF OPERATIONS WITH INTEGERS

### 1. Simplify

a)  $(-2)[-2^2 + (-1)]$

b)  $-3 - (-4)(-2 - 1)$

c)  $(-2)(-5) - [(-2)^2 + 2]$

d)  $-3 - 2[15 \div (-5) - (-2)]$

e)  $-2^2 - 3(-1)(-4)$

f)  $(-8)(-1) - 2[2^2 - 5(-1)]$

g)  $(-3)(-2)[-4 - (-2)]^2$

h)  $(-3)(-5)[-1 - 2]$

i)  $(-3)(-4) - 4 + (-2)(9 - 11)$

j)  $(-3)^2 - [-3 - 2(-1)]$

k)  $-15 \div 3 - 3[5(-2) - 2]$

l)  $(-4^2) + (-2)^2 - (-3)(-4)$

m)  $-30 \div (-5 - 1) - 2[-4^2 - (-6)]$

n)  $16 + (-2) - (-4) - (-4)^2$

o)  $-5 + 3[-12 \div 3 - (-3)^2]$

p)  $-6 + 3(-3 + 5) - 2$

q)  $-16 \div (6 + 2) - 5^2$

r)  $(-4 - 1)^2 + (-3)(2^2 - 6)$

s)  $\frac{-20 - 4}{-6 - 2} - 3^2(-2 - 2)$

t)  $-6(-1^2 - 3) - 2(-4)(-3)$

### 2. Simplify

a)  $\frac{-25}{5} - (-2)[-3^2 - 2]$

b)  $-3 - 2(-3 - 4)$

c)  $(-6)(-3) - 4(-2)$

d)  $-3 - 2[15 \div (-5) - (-2)]$

e)  $-2^2 - 2(-3)(-4)$

f)  $(6)(-1)[-4 + 2]^2$

g)  $(-2)^2 - (-12)[-3 - 2(-1)]$

h)  $(-2)(-3) - 4(-2)[-2^2 - 2]$

i)  $(4)(-2)(-3) - 4 + (-2)(9 - 12)$

j)  $-15 \div 3 - 2(4 - 6)$

k)  $(-4)^2 + (-2)^2 - 3^2$

l)  $\frac{4 + 11}{-5} + \frac{8 - 17}{-3}$

m)  $\frac{15 - 27}{-2^2} - \frac{4 - 7}{3}$

n)  $-6(-1^2 - 3) - (2)(-3)$

o)  $\frac{4 + 5(2^2 + (-3)(-4))}{8 + 12 \div (6 - 2) + (-7)}$

1. a) 10 b) -15 c) 4 d) -1 e) -16 f) -10 g) 24 h) -45 i) 12 j) 10 k) 31 l) -24 m) 25 n) 2 o) -44 p) -2 q) -27 r) 31 s) 39 t) 0

2. a) -27 b) 11 c) 26 d) -1 e) -28 f) -24 g) -8 h) -42 i) 26 j) -1 k) 11 l) 0 m) 4 n) 30 o) 21

## Whole Numbers Order of Operations Worksheet

1.  $5 \cdot 2 + 3$
2.  $8 \div 2 - 3$
3.  $3^2 + 4$
4.  $3(8 - 6) - 1^2$
5.  $16 - (10 + 5) \div 3$
6.  $2^3 + 8 - 6$
7.  $5 \cdot 2^2 + 3^2$
8.  $5 - (3 - 1) + 1$
9.  $18 - 4^2 \div 8$
10.  $2^3 + 3(5 - 2)^2$
11.  $3^3 - 2(3)$
12.  $24 - 2(1 + 2)^2$
13.  $5(7 - 4) - 1$
14.  $20 - (2 + 4) \div 3$
15.  $23 + 1^4 - 4 \cdot 5 \div 4 - 1$
16.  $20 - 10 \div 5$
17.  $14 - 2 \cdot 6$
18.  $5^2 - 5 + 2$
19.  $15 - (9 + 3) \div 6$
20.  $4(13 + 2) \div 5$
21.  $20 - 2^3 - 4$
22.  $12 - 8 \div 2$
23.  $24 \div 2 - 3 \cdot 4$
24.  $5^2 + 4(15 \div 3)$
25.  $(4 - 1)^2 + 2^3$
26.  $20 - (3 + 1)^2$
27.  $6(7 - 5)^3 - 20$
28.  $18 - (16 - 2) \div 7$
29.  $11 + 2 - 3 \cdot 4 \div 3$
30.  $4(20 - 14) \div 8 + 1$
31.  $\frac{5^2 + 3}{3^2 - 2}$
32.  $\frac{9 - (4 - 3)^4}{6 - 3 + 1}$
33.  $\frac{4(9 - 6) + 4}{3^2 - 1}$
34.  $\frac{5 - [2^3 - (4 + 2)]}{5 - 2^2}$
35.  $\frac{4[20 \div (3 + 2)]}{2^3 - 4}$
36.  $\frac{2^3 + 4 \cdot 3}{3 \cdot 2 + 4}$
37.  $\frac{3(8 + 2)}{4^2 - 1}$
38.  $\frac{2[40 \div (2 + 6)]}{8 - 2 + 4}$
39.  $5^2 - [(12 + 3) \div 5]$
40.  $8 \cdot 2 + [10 \div (7 - 2)]$

### ANSWERS

1. 13   3. 13   5. 11   7. 29   9. 16   11. 21   13. 14   15. 18   17. 2   19. 13   21. 8   23. 0  
25. 17   27. 28   29. 9   31. 4   33. 2   35. 4   37. 2   39. 22   40. 18

# BASEBALL DIAMOND PUZZLES

Solve the puzzles by finding two numbers whose product equals the top number, and whose sum equals the bottom number.

## Set One

ex:



# BASEBALL DIAMOND PUZZLES

Solve the puzzles by finding two numbers whose product equals the top number, and whose sum equals the bottom number.

## Set Two

ex:



# BASEBALL DIAMOND PUZZLES

Solve the puzzles by finding two numbers whose product equals the top number, and whose sum equals the bottom number.

## Set Three

ex:



# BASEBALL DIAMOND PUZZLES

Solve the puzzles by finding two numbers whose product equals the top number, and whose sum equals the bottom number.

## Set Four

ex:



# Fraction Operations and Evaluate Expressions

STUDENT BOOK PAGES 65–67

1. Evaluate without using a calculator.

a)  $2\frac{4}{5} + 3\frac{4}{7}$       c)  $1\frac{7}{8} + \frac{5}{6}$

b)  $4\frac{2}{9} - 3\frac{1}{4}$       d)  $4\frac{7}{9} - 2\frac{2}{3}$

2. Calculate without using a calculator.

a)  $1\frac{5}{6} + 2\frac{8}{9} + 3\frac{1}{3}$

b)  $5\frac{1}{4} - 2\frac{1}{6} - 1\frac{1}{12}$

c)  $6\frac{3}{4} - 5\frac{5}{6} + \frac{7}{8}$

3. Calculate without using a calculator.

a)  $3\frac{4}{5} \times \frac{10}{13}$       c)  $5\frac{2}{7} \times \frac{3}{10}$

b)  $4\frac{1}{8} \div 1\frac{1}{6}$       d)  $\frac{5}{7} \div 1\frac{3}{4}$

4. Find the value to replace the box.

a)  $1\frac{2}{5} \times \square = 4\frac{3}{8}$       c)  $4\frac{1}{3} \div \square = \frac{5}{7}$

b)  $\square \div 5\frac{6}{7} = \frac{3}{4}$       d)  $\square \times \frac{3}{10} = 2\frac{1}{8}$

5. Evaluate the following.

a)  $-3^2 - 4^3$

b)  $2[3 + (-2)^2]^2 - 3^3$

c)  $\frac{(-3)^2(-3 + 5)^3}{(-3)(4) + (-6)(2)}$

d)  $\frac{(20 \div 10)^2}{(32 \div 2^2)^2}$

6. Are the following true or false?

a)  $(-8)^2 = 8^2$

b)  $-(-4)^3 = -64$

c)  $-3^3 = (-3)^3$

d)  $-(-8^2) = (-2)^6$

7. Evaluate each expression for  $x = -2, y = -1$ .

a)  $x^2 - y^3$       c)  $\frac{x^3 - (-y)^4}{x^2 + y^2}$

b)  $(-2)y^2 - 3x^2$       d)  $\frac{xy - y^2x^2}{(-3)(-4)}$

8. Rewrite the following as the quotient of two integers.

a)  $4\frac{6}{7}$       c)  $5\frac{6}{11}$

b) 3.35      d) 6.12

9. Write the following rational numbers in order from least to greatest.

a)  $\frac{-2}{3}, -0.68, 0.64$       c)  $\frac{-3}{7}, \frac{4}{9}, 0.77$

b) 0.2,  $-500, \frac{1}{9}$       d)  $\frac{-2}{5}, \frac{-5}{9}, \frac{-4}{7}$

10. Calculate the following.

a)  $3\frac{8}{9} + \frac{5}{6}$       c)  $\left(4\frac{3}{5}\right)\left(-\frac{2}{3}\right)$

b)  $-7\frac{6}{7} \div \frac{3}{5}$       d)  $4\frac{2}{7} - 2\frac{1}{4}$

11. Calculate.

a)  $5\frac{1}{5}\left(-\frac{3}{10}\right) \div \left(-6\frac{7}{10}\right)\frac{1}{2}$

b)  $\left[\frac{1}{3} + \left(-\frac{5}{9}\right)\right] \div \frac{3}{2}$

c)  $\left(-3\frac{3}{4} \div 1\frac{1}{6}\right) \times \left(-2\frac{1}{2}\right)$

12. Calculate. Round answers to two decimal places.

a)  $[(5.1) - (3.1)^2]^3$

b)  $(-8.3)^2 - (-5.6)^3$

c)  $\left(4\frac{1}{5} - 3\frac{3}{10}\right)^2 - \left(2\frac{1}{3}\right)^2$

d)  $\left(-\frac{4}{5}\left(-4\frac{2}{3}\right)^2\right)^2$

13. Evaluate for the given values. Round answers to two decimal places.

a)  $(-3)a^2(-b)^3$  when  $a = -0.45, b = -2.3$

b)  $\frac{4a}{b^2}$  when  $a = -\frac{4}{5}, b = \frac{1}{3}$

c)  $[-3a + 2(-b)^2]^2$  when  $a = 0.4, b = -3.2$

# Answers: Fraction Operations and Evaluate Expressions

1. a)  $6\frac{13}{35}$  c)  $2\frac{17}{24}$

b)  $\frac{35}{36}$  d)  $2\frac{1}{9}$

2. a)  $8\frac{1}{18}$  b) 2 c)  $1\frac{19}{24}$

3. a)  $2\frac{12}{13}$  c)  $1\frac{41}{70}$

b)  $3\frac{15}{28}$  d)  $\frac{20}{49}$

4. a)  $3\frac{1}{8}$  c)  $6\frac{1}{15}$

b)  $4\frac{11}{28}$  d)  $7\frac{1}{12}$

5. a) -73 c) -3

b) 71 d)  $\frac{1}{16}$

6. a) True c) True

b) False d) True

7. a) 5 c)  $-1\frac{4}{5}$

b) -14 d)  $-\frac{1}{6}$

8. a)  $\frac{34}{7}$  c)  $\frac{61}{11}$

b)  $\frac{67}{20}$  d)  $\frac{153}{25}$

9. a) -0.68,  $\frac{-2}{3}$ , 0.64

b) -500,  $\frac{1}{9}$ , 0.2

c)  $\frac{-3}{7}$ ,  $\frac{4}{9}$ , 0.77

d)  $\frac{-4}{7}$ ,  $\frac{-5}{9}$ ,  $\frac{-2}{5}$

10. a)  $4\frac{13}{18}$  c)  $-3\frac{1}{15}$

b)  $-13\frac{2}{21}$  d)  $2\frac{1}{28}$

11. a)  $\frac{156}{335}$

b)  $\frac{-4}{27}$

c)  $8\frac{1}{28}$

12. a) -91.73 c) -4.63

b) 244.51 d) 303.53

13. a) -7.39 b) -28.80 c) 371.72

## Adding or Subtracting Signed Fractions with the Same Denominator

Evaluate each expression.

$$1) \left(-\frac{9}{5}\right) - \left(-\frac{3}{5}\right)$$

$$2) \frac{5}{4} + \left(-\frac{1}{4}\right)$$

$$3) \left(-\frac{7}{4}\right) + \frac{1}{4}$$

$$4) \left(-\frac{8}{5}\right) + \left(-\frac{4}{5}\right)$$

$$5) \frac{3}{2} + \left(-\frac{3}{2}\right)$$

$$6) \left(-\frac{5}{6}\right) + \frac{1}{6}$$

$$7) \left(-\frac{1}{3}\right) - \frac{4}{3}$$

$$8) \left(-\frac{1}{6}\right) + \frac{7}{6}$$

$$9) \left(-\frac{4}{3}\right) - \frac{4}{3}$$

$$10) \frac{15}{8} - \left(-\frac{13}{8}\right)$$

$$11) \left(-\frac{1}{4}\right) - \left(-\frac{1}{4}\right) + \frac{3}{4}$$

$$12) \frac{4}{5} - \left(-\frac{8}{5}\right) + \left(-\frac{3}{5}\right)$$

$$13) \left(-\frac{1}{2}\right) + \frac{3}{2} + \frac{1}{2}$$

$$14) \left(-\frac{1}{8}\right) + \frac{5}{8} - \left(-\frac{1}{8}\right)$$

$$15) \left(-\frac{2}{3}\right) + \left(-\frac{1}{3}\right) - \frac{4}{3}$$

$$16) \frac{1}{4} + \left(-\frac{5}{4}\right) - \frac{7}{4}$$

$$17) \left(-\frac{4}{7}\right) - \left(-\frac{1}{7}\right) + \left(-\frac{1}{7}\right)$$

$$18) \left(-\frac{1}{3}\right) - \frac{4}{3} - \frac{5}{3}$$

$$19) \frac{3}{5} + \left(-\frac{1}{5}\right) - \left(-\frac{6}{5}\right)$$

$$20) \left(-\frac{1}{2}\right) - \frac{3}{2} - \frac{3}{2}$$

## Answers to Adding or Subtracting Signed Fractions with the Same Denominator

1)  $-\frac{6}{5}$

5) 0

9)  $-\frac{8}{3}$

13)  $\frac{3}{2}$

17)  $-\frac{4}{7}$

2) 1

6)  $-\frac{2}{3}$

10)  $\frac{7}{2}$

14)  $\frac{5}{8}$

18)  $-\frac{10}{3}$

3)  $-\frac{3}{2}$

7)  $-\frac{5}{3}$

11)  $\frac{3}{4}$

15)  $-\frac{7}{3}$

19)  $\frac{8}{5}$

4)  $-\frac{12}{5}$

8) 1

12)  $\frac{9}{5}$

16)  $-\frac{11}{4}$

20)  $-\frac{7}{2}$



## Multiplying and Dividing Signed Fractions

**Evaluate.**

$$1) -\frac{1}{9} \cdot \frac{11}{6}$$

$$2) -\frac{5}{3} \cdot -\frac{5}{4}$$

$$3) \frac{4}{3} \cdot -\frac{12}{7}$$

$$4) -\frac{4}{3} \cdot \frac{3}{4}$$

$$5) \frac{7}{4} \cdot -\frac{1}{5}$$

$$6) -\frac{4}{3} \cdot -\frac{1}{2}$$

$$7) 3 \cdot -\frac{9}{5}$$

$$8) -\frac{3}{2} \cdot \frac{3}{10}$$

$$9) -2 \cdot \frac{6}{5}$$

$$10) 2 \cdot -\frac{6}{7}$$

$$11) \frac{-8}{5} \div \frac{-5}{3}$$

$$12) \frac{4}{3} \div \frac{-3}{2}$$

$$13) \frac{11}{10} \div \frac{9}{10}$$

$$14) \frac{11}{6} \div -2$$

$$15) \frac{7}{6} \div \frac{-13}{10}$$

$$16) \frac{8}{5} \div \frac{1}{3}$$

$$17) \frac{1}{2} \div \frac{-1}{2}$$

$$18) 2 \div \frac{-7}{4}$$

$$19) \frac{-1}{3} \div \frac{5}{4}$$

$$20) \frac{-10}{9} \div -1$$

## Answers to Multiplying and Dividing Signed Fractions

1)  $-\frac{11}{54}$

5)  $-\frac{7}{20}$

9)  $-\frac{12}{5}$

13)  $\frac{11}{9}$

17)  $-1$

2)  $\frac{25}{12}$

6)  $\frac{2}{3}$

10)  $-\frac{12}{7}$

14)  $-\frac{11}{12}$

18)  $-\frac{8}{7}$

3)  $-\frac{16}{7}$

7)  $-\frac{27}{5}$

11)  $\frac{24}{25}$

15)  $-\frac{35}{39}$

19)  $-\frac{4}{15}$

4)  $-1$

8)  $-\frac{9}{20}$

12)  $-\frac{8}{9}$

16)  $\frac{24}{5}$

20)  $\frac{10}{9}$

# Powers: Multiply/Divide

STUDENT BOOK PAGES 83–91

Simplify  $\frac{n^3}{n^5}$ .

Use the definition of a power.

$$\frac{n^3}{n^5} = \frac{nnn}{nnnnn} = \frac{nnn}{(nnn)(nn)} = \frac{1}{n^2}$$

1. Simplify.

a)  $(4^3)(4^5)$       c)  $(5^3)(5^2)(c^4)(c)$

b)  $(x^2)(x^3)$       d)  $\left(\frac{2}{3}\right)^2\left(\frac{2}{3}\right)^4\left(\frac{2}{3}\right)^4$

2. Simplify.

a)  $(a^2)(b^5)(a^3)(b^3)$

b)  $(x^3)(y^2)(y^5)(x^4)(x^2)$

c)  $3^2(c^2)(c^2)3^4(c^5)$

d)  $(n^2)4^2(n^3)4^3(n^3)$

e)  $(y^3)(-5)(y^3)(-5)^2$

f)  $(4^3)(p^2)(p^2)(4)(p)$

3. Simplify.

a)  $\frac{4^5}{4^3}$

d)  $\frac{(m^3)(m^3)}{m^5}$

b)  $\frac{n^6}{n^3}$

e)  $\frac{3^2(a^4)(a^2)}{3(a^4)}$

c)  $\frac{(c^4)(c^5)}{c^2}$

f)  $\frac{(-2)^3x^8}{(-2)(x^2)(x^3)}$

4. Simplify.

a)  $\frac{(4^5)(a^6)(4^3)}{(4^3)a^5}$

c)  $\frac{(ab)^6}{a^2b^3}$

b)  $\frac{(8^8)c^3d^2}{(8^5)cd}$

d)  $\frac{x^5y^4}{(xy)^2}$

5. Simplify.

a)  $\frac{x^3}{x^4}$

c)  $\frac{(ab)^2}{a^2b^4}$

b)  $\frac{x^2y^2}{x^3y}$

d)  $\frac{x^3y^4}{x^5y^2}$

6. Simplify if possible. Then evaluate.

a)  $\frac{5^6}{5^4}$

d)  $\frac{(2.4^5)(2.4^4)}{2.4^5}$

b)  $\frac{(3^5)(3^5)}{3^6}$

e)  $\frac{\left(\frac{2}{3}\right)^5}{\left(\frac{2}{3}\right)^3}$

c)  $\frac{(4^3)(2^3)(2^4)(4)}{(2^4)(4^2)}$

f)  $\frac{\left(\frac{3}{4}\right)^5\left(\frac{3}{4}\right)^2}{\left(\frac{3}{4}\right)^4}$

7. Simplify, and then evaluate for  $x = 3$  and  $y = 2$ .

a)  $\frac{(x^3)(x^2)}{x^4}$

d)  $\frac{8x^5y^4}{4x^4y^2}$

b)  $\frac{(y^6)(x^4)}{(x^3)(y^2)}$

e)  $\frac{\left(\frac{1}{2}xy\right)^2}{\left(\frac{1}{2}\right)^2x^2y}$

c)  $\frac{150y^4}{50y^2}$

f)  $\frac{\left(\frac{2}{3}\right)^2x^3y^3}{\left(\frac{2}{3}xy\right)^2}$

8. If you know that the product of two powers is  $5^8$  and that the quotient is  $5^4$ , what could the two powers be? How could you verify your answer?

## Answers: Powers: Multiply/Divide

1. a)  $4^8$   
b)  $x^5$   
c)  $(5^5)(c^5)$   
d)  $\left(\frac{2}{3}\right)^{10}$
2. a)  $(a^5)(b^8)$   
b)  $(x^9)(y^7)$   
c)  $3^6(c^9)$   
d)  $4^5(n^8)$   
e)  $(-5)^3(y^6)$   
f)  $4^4(p^5)$
3. a)  $4^2$   
b)  $n^3$   
c)  $c^7$   
d)  $m$   
e)  $3a^2$   
f)  $(-2)^2x^3$
4. a)  $(4^5)a$   
b)  $8^3c^2d$   
c)  $a^4b^3$   
d)  $x^3y^2$
5. a)  $\frac{1}{x}$   
b)  $\frac{y}{x}$   
c)  $\frac{1}{b^2}$   
d)  $\frac{y^2}{x^2}$
6. a)  $5^2 = 25$   
b)  $3^4 = 81$   
c)  $(4^2)(2^3) = 128$   
d)  $(2.4)^4 = 33.1776$   
e)  $\left(\frac{2}{3}\right)^2 = \frac{4}{9}$   
f)  $\left(\frac{3}{4}\right)^3 = \frac{27}{64}$
7. a)  $x = 3$   
b)  $xy^4 = 48$   
c)  $3y^2 = 12$   
d)  $2xy^2 = 24$   
e)  $y = 2$   
f)  $xy = 6$
8. I know that the sum of the exponents is 8 and the difference is 4. The powers could be  $5^6$  and  $5^2$ . I can check by seeing that  $(5^6)(5^2) = 5^8$  and  $\frac{5^6}{5^2} = 5^4$ .

# Powers of Powers

STUDENT BOOK PAGES 92–99

Simplify  $\left(\frac{x^4}{x^3}\right)^2$ .

$$\begin{aligned}\left(\frac{x^4}{x^3}\right)^2 &= \frac{x^{4 \cdot 2}}{x^{3 \cdot 2}} \\ &= \frac{x^8}{x^6} \\ &= x^2\end{aligned}$$

The outer exponent refers to each term inside the brackets.

To simplify a power of a power, multiply the exponents.

To divide when the bases are the same, subtract the exponents.

1. Express each of the following as a power with a single exponent.

- a)  $(3^2)^3$       c)  $(2^4)^3$       e)  $(x^3)^4$   
b)  $(8^2)^2$       d)  $(10^5)^5$       f)  $(y^2)^5$

2. Express each of the following as a power with the base indicated.

- a)  $36^3$  with a base of 6  
b)  $64^2$  with a base of 4  
c)  $81^2$  with a base of 9  
d)  $81^2$  with a base of 3

3. Simplify.

- a)  $(2^5)^2(2^3)$       d)  $\frac{(10^3)^3}{(10^2)^4}$   
b)  $(3^4)^2(3^4)^2$       e)  $\frac{(2^4 \times 2^2)^3}{(2^3 \times 2)^3}$   
c)  $\frac{(5^2)^3}{5^3}$       f)  $\left(\frac{5^6}{5^3}\right)^3$

4. Simplify.

- a)  $(x^4)^3$       c)  $(d^4)^4$   
b)  $(n^2)^4$       d)  $(x^2)^6$

5. Simplify.

- a)  $(p^2)^3(p)$       d)  $\frac{(c^6)^3}{(c^4)^3}$   
b)  $(m^2)^4(m^3)^3$       e)  $\frac{(x^2y)^4}{(xy^2)^2}$   
c)  $\frac{(x^4)^2}{x^3}$       f)  $\left(\frac{v^5}{v^3}\right)^2$

6. Simplify.

- a)  $(2x^3)^3$       c)  $(2x^3 \times 3y^2)^2$   
b)  $(-3n^2)^5$       d)  $(4a^3b^4)^2$

7. Simplify.

- a)  $(2^3 \times 3^4)^2(2^4 \times 3^2)^3$   
b)  $(2x^2)^5(2x^4)^3$   
c)  $\frac{(3^4 \times 5^2)^3}{(3^2 \times 5)^3}$   
d)  $\frac{(2x^4)^3}{(2x^3y)^3}$

8. Simplify.

- a)  $(5a^2)^5$       c)  $(2x^2)^3(2^2x^4y^2)^2$   
b)  $(4b^3)^4$       d)  $\frac{(3^2n^3)^5}{(3^3n^2)^3}$

9. Evaluate.

- a)  $\frac{(2^2)^4}{(2^3)^2}$       d)  $\frac{(2^3)^2(3^4)^2}{(3^6)(2^5)}$   
b)  $\frac{(4^3)^4}{(4^3)^3}$       e)  $\frac{(3^3)(4^4)}{(3^2)^3(4^2)^2}$   
c)  $\frac{(5)(3^3)^2}{(3^2)^2}$       f)  $\frac{[(5^3)^2]^4}{[(5^2)^5]^2}$

10. Simplify and evaluate each. Use  $a = 2$ ,  $b = -2$ , and  $c = 3$ .

- a)  $\frac{(a^3)^2}{a^2}$       c)  $\frac{(c^3)^4}{c^6}$   
b)  $(b^4)^3$       d)  $\frac{a^2b^5}{(ab)^2}$

11. Determine the value of the exponent that makes each statement true.

- a)  $25^4 = 5^?$   
b)  $3^{12} = 81^?$   
c)  $225^4 = 15^?$   
d)  $36^6 = 6^?$

12. Write each power in simplified form.

- a)  $4^8$  as a power of 2  
b)  $16^6$  as a power of 4  
c)  $81^4$  as a power of 3  
d)  $(-64)^5$  as a power of  $(-4)$

# Answers: Powers of Powers

1. a)  $3^6$   
b)  $8^4$   
c)  $2^{12}$   
d)  $10^{25}$   
e)  $x^{12}$   
f)  $y^{10}$
2. a)  $6^6$   
b)  $4^6$   
c)  $9^4$   
d)  $3^8$
3. a)  $2^{13}$   
b)  $3^{16}$   
c)  $5^3$   
d) 10  
e)  $2^6$   
f)  $5^9$
4. a)  $x^{12}$   
b)  $n^8$   
c)  $d^{16}$   
d)  $x^{12}$
5. a)  $p^7$   
b)  $m^{17}$   
c)  $x^5$   
d)  $c^6$   
e)  $x^6$   
f)  $v^4$
6. a)  $8x^9$   
b)  $-243n^{10}$   
c)  $36x^6y^4$   
d)  $16a^6b^8$
7. a)  $2^{18} \times 3^{14}$   
b)  $2^8x^{22}$   
c)  $3^6 \times 5^3$   
d)  $\frac{x^3}{y^3}$
8. a)  $5^5a^{10}$   
b)  $4^4b^{12}$   
c)  $2^7x^{14}y^4$   
d)  $3n^9$
9. a) 4  
b) 64  
c) 45  
d) 18  
e)  $\frac{1}{27}$   
f) 625
10. a)  $a^4 = 16$   
b)  $b^{12} = 4096$   
c)  $c^6 = 729$   
d)  $b^3 = -8$
11. a) 8  
b) 3  
c) 8  
d) 12
12. a)  $2^{16}$   
b)  $4^{12}$   
c)  $3^{16}$   
d)  $(-4)^{15}$

# Simplifying Polynomial Expressions

1. Simplify.

- a)  $4(5x^2 + 10)$       b)  $7(2a - 5)$       c)  $-8(3k^2 - 2k)$   
 d)  $12(2b^2 - 3b + 9)$       e)  $-9(-5m^2 + 7m - 3)$       f)  $3(8p^2 - 5p + 7)$

2. Simplify.

- a)  $3(x + 4) + 7$       b)  $-8(2a - 3) + 11a$       c)  $5(y + 2) - 7y$   
 d)  $4(7m - 5) - 13$       e)  $-6(3p^2 + 2p) + 5p^2$       f)  $7(5x - 3y) - 43x$

3. Simplify.

- a)  $12x(5x - 4)$       b)  $3a(-7a + 2)$       c)  $6p(2p - q)$   
 d)  $-15n^2(6 - 9n)$       e)  $7m^3(3mn + 6)$       f)  $-8x^2(5x + 7y)$

4. Simplify.

- a)  $3(x + 2) + 2(x - 6)$       b)  $2(x + 9) - 3(x + 7)$   
 c)  $3(2a + 10b - 2c) - 6(a - 2b + 5c)$       d)  $3(2m - 4n + 3) - 5(-2m + 5n - 1)$

5. Simplify.

- a)  $3x^2(x + y) + 2x^2(3x + 5y)$       b)  $3a^3(2a - 5b) - 4a^3(2a + 3b)$   
 c)  $5p^2(4p - q) - 8p^2(2p - 7q)$       d)  $6a^3(-3a + 7b - 4) - 8a^3(2a - 3b + 7)$

6. In a hockey league, each team plays all other teams 4 times. If there are  $n$  teams, write a formula for the total number of games to be played.

7. Simplify.

- a)  $-2ab^2(ab - a^2 + b)$       b)  $3x^2y(xy^2 + xy - y)$   
 c)  $-5m^2n(3mn + mn^2 - n^2)$       d)  $5x(x - y) - 2y(x + y - 1) + y^2$   
 e)  $2b(b^2 - bc) - 2c(b - c) + (7bc - 4c^2)$       f)  $7x(x^2 - y^2) - 2xy - 2y(x^2 + y^2)$

- 1.a)  $20x^2 + 40$  b)  $14a - 35$  c)  $16k - 24k^2$   
 d)  $24b^2 - 36b + 108$  e)  $45m^2 - 63m + 27$   
 f)  $24p^2 - 15p + 21$  2.a)  $3x + 19$  b)  $24 - 5a$  c)  $10 - 2y$   
 d)  $28m - 33$  e)  $-13p^2 - 12p$  f)  $-8x - 21y$   
 3.a)  $60x^2 - 48x$  b)  $6a - 21a^2$  c)  $12p^2 - 6pq$   
 d)  $135n^3 - 90n^2$  e)  $21m^4n + 42m^3$  f)  $-56x^2y - 40x^3$   
 4.a)  $5x - 6$  b)  $-x - 3$  c)  $42b - 36c$  d)  $16m - 37n + 14$   
 5.a)  $9x^3 + 13x^2y$  b)  $-2a^4 - 27a^3b$  c)  $4p^3 + 51p^2q$   
 d)  $-34a^4 + 66a^3b - 80a^3$  6.  $2n(n - 1)$   
 7.a)  $2a^3b^2 - 2a^2b^3 - 2ab^3$  b)  $3x^3y^3 + 3x^3y^2 - 3x^2y^2$   
 c)  $5m^2n^3 - 5m^3n^3 - 15m^3n^2$  d)  $5x^2 - y^2 - 7xy + 2y$   
 e)  $2b^3 - 2b^2c - 2c^2 + 5bc$   
 f)  $7x^3 - 7xy^2 - 2xy - 2x^2y - 2y^3$

# Polynomial Addition and Subtraction

**Simplify. Write each answer in standard form.**

19.  $(3x^2 - 5x) - (x^2 + 4x + 3)$
20.  $(2x^3 - 4x^2 + 3) + (x^3 - 3x^2 + 1)$
21.  $(3y^3 - 11y + 3) - (5y^3 + y^2 + 2)$
22.  $(3x^2 + 2x^3) - (3x^2 + 7x - 1)$
23.  $(2a^3 + 3a^2 + 7a) + (a^3 + a^2 - 2a)$
24.  $(8y^3 - y + 7) - (6y^3 + 3y - 3)$
25.  $(x^2 - 6) + (5x^2 + x - 3)$
26.  $(5n^2 - 7) - (2n^2 + n - 3)$
27.  $(5n^3 + 2n^2 + 2) - (n^3 + 3n^2 - 2)$
28.  $(3y^2 - 7y + 3) - (5y + 3 - 4y^2)$
29.  $(2x^2 + 9x - 17) + (x^2 - 6x - 3)$
30.  $(3 - x^3 - 5x^2) + (x + 2x^3 - 3)$
31.  $(3x + x^2 - x^3) - (x^3 + 2x^2 + 5x)$
32.  $(d^2 + 8 - 5d) - (5d^2 + d - 2d^3 + 3)$
33.  $(3x^3 + 7x^2) + (x^2 - 2x^3)$
34.  $(6c^2 + 5c - 3) - (3c^2 + 8c)$
35.  $(3y^2 - 5y - 7) + (y^2 - 6y + 7)$
36.  $(3c^2 - 8c + 4) - (7 + c^2 - 8c)$
37.  $(4x^2 + 13x + 9) + (12x^2 + x + 6)$
38.  $(2x - 13x^2 + 3) - (2x^2 + 8x)$
39.  $(7x - 4x^2 + 11) + (7x^2 + 5)$
40.  $(4x + 7x^3 - 9x^2) + (3 - 2x^2 - 5x)$
41.  $(y^3 + y^2 - 2) + (y - 6y^2)$
42.  $(x^2 - 8x - 3) - (x^3 + 8x^2 - 8)$
43.  $(3x^2 - 2x + 9) - (x^2 - x + 7)$
44.  $(2x^2 - 6x + 3) - (2x + 4x^2 + 2)$
45.  $(2x^2 - 2x^3 - 7) + (9x^2 + 2 + x)$
46.  $(3a^2 + a^3 - 1) + (2a^2 + 3a + 1)$
47.  $(2x^2 + 3 - x) - (2 + 2x^2 - 5x)$
48.  $(n^4 - 2n - 1) + (5n - n^4 + 5)$
49.  $(x^3 + 3x) - (x^2 + 6 - 4x)$
50.  $(7s^2 + 4s + 2) + (3s + 2 - s^2)$
51.  $(6x^2 - 3x + 9) - (x^2 + 3x - 5)$
52.  $(3x^3 - x^2 + 4) + (2x^3 - 3x + 9)$
53.  $(y^3 + 3y - 1) - (y^3 + 3y + 5)$
54.  $(3 + 5x^3 + 2x) - (x + 2x^2 + 4x^3)$
55.  $(x^2 + 15x + 13) + (3x^2 - 15x + 7)$
56.  $(7 - 8x^2) + (x^3 - x + 5)$
57.  $(2x + 3) - (x - 4) + (x + 2)$
58.  $(x^2 + 4) - (x - 4) + (x^2 - 2x)$

## Answers

19.  $2x^2 - 9x - 3$  20.  $3x^3 - 7x^2 + 4$   
 21.  $-2y^3 - y^2 - 11y + 1$  22.  $2x^3 - 7x + 1$   
 23.  $3a^3 + 4a^2 + 5a$  24.  $2y^3 - 4y + 10$  25.  $6x^2 + x - 9$   
 26.  $3n^2 - n - 4$  27.  $4n^3 - n^2 + 4$  28.  $7y^2 - 12y$   
 29.  $3x^2 + 3x - 20$  30.  $x^3 - 5x^2 + x$  31.  $-2x^3 - x^2 - 2x$   
 32.  $2d^3 - 4d^2 - 6d + 5$  33.  $x^3 + 8x^2$  34.  $3c^2 - 3c - 3$   
 35.  $4y^2 - 11y$  36.  $2c^2 - 3$  37.  $16x^2 + 14x + 15$   
 38.  $-15x^2 - 6x + 3$  39.  $3x^2 + 7x + 16$   
 40.  $7x^3 - 11x^2 - x + 3$  41.  $y^3 - 5y^2 + y - 2$   
 42.  $-x^3 - 7x^2 - 8x + 5$  43.  $2x^2 - x + 2$   
 44.  $-2x^2 - 8x + 1$  45.  $-2x^3 + 11x^2 + x - 5$   
 46.  $a^3 + 5a^2 + 3a$  47.  $4x + 1$  48.  $3n + 4$   
 49.  $x^3 - x^2 + 7x - 6$  50.  $6s^2 + 7s + 4$   
 51.  $5x^2 - 6x + 14$  52.  $5x^3 - x^2 - 3x + 13$  53.  $-6$   
 54.  $x^3 - 2x^2 + x + 3$  55.  $4x^2 + 20$   
 56.  $x^3 - 8x^2 - x + 12$  57.  $2x + 9$  58.  $2x^2 - 3x + 8$



# Ratio and Proportion

Find each unit rate.

- \$60 for 8 h
- $\frac{\$3}{4 \text{ lb}}$
- $\frac{861 \text{ bagels}}{3 \text{ d}}$
- $\frac{850 \text{ cal}}{1.25 \text{ h}}$
- An 8-ounce bottle of lotion costs \$4.50. What is the cost per ounce?
- A pound of coffee costs \$14.99. What is the cost per ounce?

Which pairs of ratios could form a proportion? Justify your answer.

- $\frac{10}{24}, \frac{7}{18}$
- $\frac{6}{9}, \frac{10}{15}$
- $\frac{3}{4}, \frac{18}{24}$
- $\frac{16}{2}, \frac{8}{1}$
- $-\frac{4.8}{4}, -\frac{6.4}{5}$

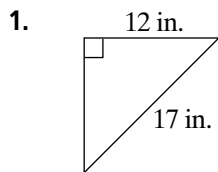
Solve each proportion.

- $\frac{g}{5} = \frac{6}{10}$
- $\frac{z}{4} = \frac{7}{8}$
- $\frac{13.2}{6} = \frac{m}{12}$
- $-\frac{m}{5} = -\frac{2}{5}$
- $\frac{5.5}{11} = \frac{x}{5}$
- $-\frac{2}{3} = -\frac{10}{t}$
- $\frac{4}{6} = \frac{x}{24}$
- $\frac{s}{3} = \frac{7}{10}$
- $\frac{4}{9} = \frac{10}{r}$
- $\frac{x}{4.8} = \frac{6}{3.2}$
- $\frac{5}{4} = \frac{c}{12}$
- $-\frac{32}{h} = -\frac{1}{3}$
- $\frac{2}{6} = \frac{p}{9}$
- $\frac{f}{6} = \frac{3}{4}$
- $\frac{15}{a} = \frac{3}{8}$
- $\frac{3}{4} = \frac{k}{24}$
- $\frac{a}{6} = \frac{3}{9}$
- $\frac{4}{5} = \frac{k}{9}$
- $\frac{3}{y} = \frac{5}{8}$
- $\frac{t}{7} = \frac{9}{21}$
- $\frac{2}{9} = \frac{10}{x}$
- $\frac{x}{15} = \frac{3}{4}$
- $\frac{18}{11} = \frac{49.5}{x}$
- $\frac{2}{1.2} = \frac{5}{x}$
- $-\frac{x-1}{4} = \frac{2}{3}$
- $\frac{3}{6} = \frac{x-3}{8}$
- $\frac{2x-2}{14} = \frac{2x-4}{6}$
- $\frac{x+2}{x-2} = \frac{4}{8}$
- $\frac{x+2}{6} = \frac{x-1}{12}$
- $-\frac{x+8}{10} = -\frac{x-3}{2}$
- You are riding your bicycle. It takes you 28 min to go 8 mi. If you continue traveling at the same rate, how long will it take you to go 15 mi?
- Suppose you traveled 84 mi in 1.5 h. Moving at the same speed, how many mi would you cover in  $3\frac{1}{4}$  h?
- A canary's heart beats 130 times in 12 s. Use a proportion to find how many times its heart beats in 50 s.
- Your car averages 18 mi per gal on the highway. If gas costs \$1.85 per gal, how much does it cost in dollars per mi to drive your car on the highway?

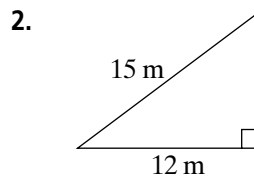
- \$7.50/h
- \$0.75/lb
- 287 bagels/d
- 680 cal/h
- \$0.56/oz
- \$0.94/oz
- no;  $168 \neq 180$
- yes;  $90 = 90$
- yes;  $72 = 72$
- yes;  $16 = 16$
- no;  $-24 \neq -25.6$
- 3
- 3.5
- 26.4
- 2
- 2.5
- 15
- 16
- 2.1
- 22.5
- 9
- 15
- 96
- 3
- 4.5
- 40
- 18
- 2
- 7.2
- 4.8
- 3
- 45
- 11.25
- 30.25
- 3
- $-\frac{5}{3}$
- 7
- 2.75
- 6
- 5
- 5.75
- 52.5 min
- 182 mi
- $541\frac{2}{3}$  beats
- \$0.10/mi

# Solve Equations: Pythagorean Theorem

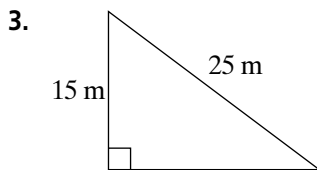
Find the missing leg length. If necessary, round the answer to the nearest tenth.



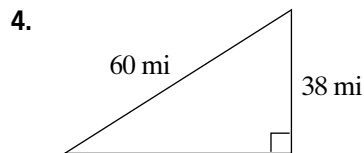
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\_\_\_\_\_

For Exercises 5–14,  $a$  and  $b$  represent leg lengths and  $c$  represents the length of the hypotenuse. Find the missing leg length. If necessary, round to the nearest tenth.

5.  $a = 8$  cm,  $c = 12$  cm

\_\_\_\_\_

6.  $b = 9$  in.,  $c = 15$  in.

\_\_\_\_\_

7.  $b = 5$  m,  $c = 25$  m

\_\_\_\_\_

8.  $a = 36$  in.,  $c = 39$  in.

\_\_\_\_\_

9.  $a = 10$  m,  $c = 20$  m

\_\_\_\_\_

10.  $b = 24$  mm,  $c = 25$  mm

\_\_\_\_\_

11.  $a = 9$  yd,  $c = 41$  yd

\_\_\_\_\_

12.  $b = 10$  cm,  $c = 26$  cm

\_\_\_\_\_

13.  $b = 27$  yd,  $c = 130$  yd

\_\_\_\_\_

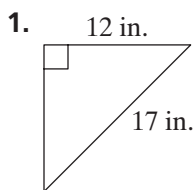
14.  $a = 11$  mi,  $c = 61$  mi

\_\_\_\_\_

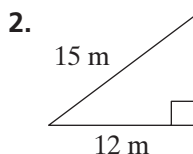
15. One leg of a right triangle is 4 ft long and the hypotenuse is 5 ft long. Ritchie uses  $\sqrt{4^2 + 5^2}$  to find the length of the other leg. Is Ritchie correct in his approach? Why or why not?

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

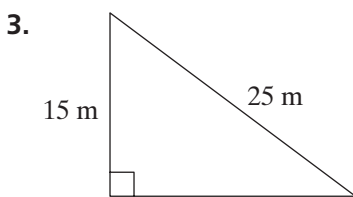
# Answers: Solve Equations: Pythagorean Theorem



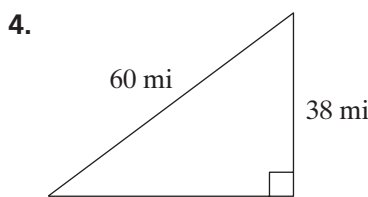
12.0 in.



9 m



20 m



46.4 mi

For Exercises 5–14,  $a$  and  $b$  represent leg lengths and  $c$  represents the length of the hypotenuse. Find the missing leg length. If necessary, round to the nearest tenth.

5.  $a = 8$  cm,  $c = 12$  cm

8.9 cm

6.  $b = 9$  in.,  $c = 15$  in.

12 in.

7.  $b = 5$  m,  $c = 25$  m

24.5 m

8.  $a = 36$  in.,  $c = 39$  in.

15 in.

9.  $a = 10$  m,  $c = 20$  m

17.3 m

10.  $b = 24$  mm,  $c = 25$  mm

7 mm

11.  $a = 9$  yd,  $c = 41$  yd

40 yd

12.  $b = 10$  cm,  $c = 26$  cm

24 cm

13.  $b = 27$  yd,  $c = 130$  yd

127.2 yd

14.  $a = 11$  mi,  $c = 61$  mi

60 mi

15. One leg of a right triangle is 4 ft long and the hypotenuse is 5 ft long. Ritchie uses  $\sqrt{4^2 + 5^2}$  to find the length of the other leg. Is Ritchie correct in his approach? Why or why not?

No; Ritchie needs to calculate  $\sqrt{5^2 - 4^2}$ , since the

hypotenuse is the longest side.

# Solving Equations: Multiple Steps

1. Solve and check.

- a)  $3x - 4 = 23$       b)  $2m + 5 = -21$       c)  $-5a - 7 = -62$   
d)  $8y + 3 = -37$       e)  $2(3x - 5) = 32$       f)  $5(3x + 4) = -10$   
g)  $9x - (4x + 7) = 28$       h)  $4x - (7x - 8) = -25$       i)  $4(x - 3) + 9x = -38$

2. Solve.

- a)  $7m + 2 = 5m + 18$       b)  $11x - 18 = 3 + 8x$       c)  $9x - 30 = -3(5x - 6)$   
d)  $13b - 12 = 49b + 24$       e)  $4(5 + x) = x + 5$       f)  $6x + 10 = 15x + 64$   
g)  $3(x - 5) = 2(5x - 11)$       h)  $3(2r + 4) = 4(5r - 4)$       i)  $19m + 42 = 25m + 6$

3. Find the root of each equation.

- a)  $x - 5 = 8 - 2(x + 2)$       b)  $4(x + 1) = 10 - (2x + 6)$   
c)  $3 - (2 + 4x) = 4 + 2(3x + 1)$       d)  $12(a - 3) - 35 = 5(13 - a)$   
e)  $3(y - 2) - 8 = 68 - 2(2y - 1)$       f)  $3x + 7(2 - x) = 14 - 9x - 3$   
g)  $17x - 9(1 + x) = 4(3x - 1) + 7$       h)  $4(x - 9) + 52 = 2(3x + 17) + 2x$   
i)  $2(5x - 11) - 6 = 3(x - 7) - 15$       j)  $13x - (3x + 12) - 5x = 7x - (5x - 3)$

4. The cost,  $C$ , in dollars, of producing  $n$  videos is given by the formula:  
 $C = 12\,000 + 3n$ . How many videos can be produced for \$30 000?
- 

5. The cost,  $C$ , in dollars, of renting a car for one day is given by the formula:  
 $C = 25 + 0.15d$ , where  $d$  is the number of kilometres driven. How far could you drive for \$60?

6. In a province where the rate of sales tax is 8%, the total cost,  $C$ , of a taxable item is given by the formula:  $C = 1.08s$ , where  $s$  is the sticker price. If you have \$20, what is the highest sticker price on an item you could buy?

7. Certain bank accounts give daily interest according to the formula:  $I = \frac{Prt}{365}$ , where  $P$  is the principal,  $r$  is the annual interest rate expressed as a decimal, and  $t$  is the time in days. Teri deposits \$50 in an account which pays 7% annual interest.

- a) What interest would she receive after 23 days?  
b) How many days would she need to keep the money in the account to earn \$1 in interest?

8. Solve.

- a)  $\frac{7x}{6} = \frac{7}{2}$       b)  $\frac{x}{5} + \frac{1}{2} = \frac{3}{10}$       c)  $\frac{3m}{5} - \frac{1}{2} = \frac{7}{10}$   
d)  $\frac{2x}{9} + \frac{1}{3} = -\frac{1}{6}$       e)  $\frac{1}{2}x - \frac{1}{3}x = \frac{7}{3}$       f)  $\frac{2x}{5} + \frac{3}{4} = \frac{4x}{5} - \frac{1}{2}$

## Solving Equations: Multiple Steps (continued)

### 9. Solve and check.

a)  $2(5x - 11) + 7 = 3(x - 7) - 15$

b)  $13x - (3x + 12) = 12x - (5x - 3)$

c)  $2(x - 6) + 3x = 2(x + 2) - x$

d)  $9(3 + y) - 16 = 8(y + 4) + 5$

e)  $15 - 2(3 + 2x) = 4 + 3(2x - 5)$

f)  $3x(x - 5) - 3x(x + 7) = 72$

g)  $4(3x + 1) - 6(x - 3) = 4(2x - 7) + 34$

h)  $2x(3x + 4) - 19 = x(6x - 2) + 31$

### 10. Solve.

a)  $3(a - 2) - 5(a - 3) = 17$

b)  $2(3k - 5) + 3(k - 5) = 7(k - 1)$

c)  $5(2n - 3) - 2(n - 1) = 5(n - 1) - 2$

d)  $8(y + 8) + 11 = 2(2y - 7) - 3(4y - 3)$

e)  $3(3x - 2) - 4(x - 1) = 14 + x$

f)  $2(2c - 5) + 20 = 3c(c + 5) - 3c(c + 7)$

g)  $15r^2 - 7 - 5r(3r + 4) = 3(7 - 4r)$

h)  $6 + 2(g + 4) = -11g + 4(g - 9) + 5$

i)  $5z(z - 2) - 3(2z - 1) = 5z(z - 3) + 7$

j)  $3(4p - 5) - 2(p + 1) = 4 - (p - 5)$

### 11. Solve.

a)  $\frac{5m}{6} + \frac{2m}{3} = \frac{9}{2}$

b)  $\frac{y + 3}{3} = \frac{3y - 5}{2}$

c)  $\frac{a - 2}{6} - 5 = \frac{a + 3}{3}$

d)  $\frac{x + 4}{3} - \frac{x - 5}{6} = 4$

e)  $\frac{2s + 7}{3} = \frac{s + 3}{5} + \frac{s - 1}{-1}$

f)  $\frac{5x + 2}{3} + 2 = \frac{2x - 3}{4} + \frac{1}{2}$

## Answers

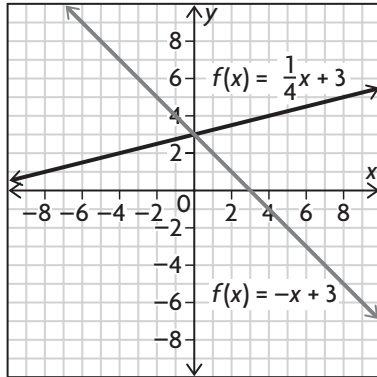
1.a)9 b)-13 c)11 d)-5 e)7 f)-2 g)7 h)11 i)-2  
 2.a)8 b)7 c)2 d)-1 e)-5 f)-6 g)1 h)2 i)6 3.a)3  
 b)0 c)- $\frac{1}{2}$  d)8 e)12 f)- $\frac{3}{5}$  g)-3 h)- $\frac{9}{2}$  i)- $\frac{8}{7}$  j)5 4.6000  
 5.233 km 6.\$18.52 7.a)22¢ b)105 days 8.a)3 b)-1  
 c)2 d)- $\frac{9}{4}$  e)14 f) $\frac{25}{8}$  9.a)-3 b)5 c)4 d)26 e)2 f)-2  
 g)8 h)5 10.a)-4 b)9 c)2 d)-5 e)4 f)-1 g)- $\frac{7}{2}$  h)-5  
 i)-4 j) $\frac{26}{11}$  11.a)3 b)3 c)-38 d)11 e)- $\frac{1}{2}$  f)- $\frac{5}{2}$   
 12.a) $\frac{7+b}{a}$  b) $\frac{e+d}{b+3}$  c) $\frac{3a}{2b-c}$  d) $\frac{d-b}{a-c}$  e) $\frac{b+c}{3a-2}$  f) $\frac{5b-2a}{2}$   
 g)-c h)c + b i) $\frac{4b+5c}{2a-5}$  13.x = -3 is a root for parts a),  
 c), and d); x = -3 is the only root for part c). 14.a)12  
 b)14 c)4 d)-1

# Solve Equations: Point of Intersection of two equations

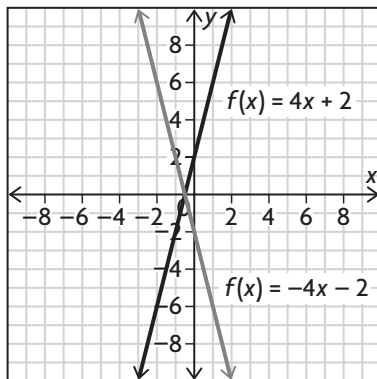
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1. Determine the point of intersection for each system of linear equations shown below.

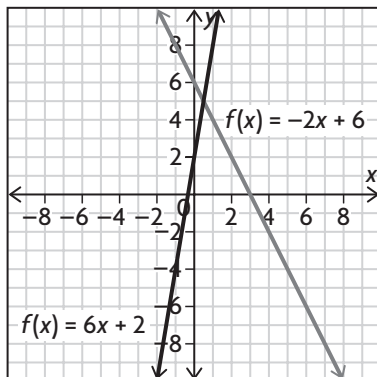
a)  $y = \frac{1}{4}x + 3$  and  $y = -x + 3$



b)  $y = x + 2$  and  $y = -3x + 6$   
 c)  $y = 4x + 2$  and  $y = -4x - 2$



d)  $y = -5x + 1$  and  $y = x - 5$   
 e)  $y = -2x + 6$  and  $y = 6x + 2$



2. How many points of intersection do the following lines have?

a)  $y = 3x + 1$  and  $y = -2x + 2$

b)  $y = 4x - 2$  and  $y = 7x + 3$

c)  $y = 2x - 10$  and  $y = 2x + 3$

d)  $y = 3x + 7$  and  $y = \frac{6x + 14}{2}$

3. Determine the point of intersection of each pair of lines.

a)  $y = 2$  and  $y = 5$

b)  $y + 2x = 7$  and  $y - 2x = 3$

c)  $y = \frac{4x - 8}{2}$  and  $y = -4x$

d)  $y = -x + 1$  and  $y = x - 1$

4. Does each pair of lines intersect at the given point?

a)  $(1, 3)$ :  $y = x + 2$  and  $y = -2x + 4$

b)  $(-\frac{1}{2}, 3)$ :  $y = -6x$  and  $y = 2x + 4$

c)  $(-1, 1)$ :  $y = -x$  and  $y = x + 2$

d)  $(0, 3)$ :  $y = 3$  and  $y = x$

e)  $(-2, -4)$ :  $y = -4$  and  $y = 4x + 4$

5. Determine the point of intersection of each pair of lines.

a)  $x = y - 4$  and  $x = \frac{y - 4}{3}$

b)  $\frac{1}{3}x - y = -2$  and  $y = 2$

c)  $x = 3$  and  $y = 3$

d)  $4x = 8y - 2$  and  $2x = 2y$

6. If two linear equations can be simplified to have the same equation, how many solutions does the system of linear equations have?

7. If two linear equations have the same slope, how many solutions does the system of linear equations have?

8. If two lines are parallel, how many solutions does the system of linear equations have?

## Answers: Solve Equations: Point of Intersection of two equations

1. a)  $(0, 3)$

b)  $(1, 3)$

c)  $\left(-\frac{1}{2}, 0\right)$

d)  $(1, -4)$

e)  $\left(\frac{1}{2}, 5\right)$

2. a) 1

b) 1

c) 0

d) infinite

3. a) none, no intersection

b)  $(1, 5)$

c)  $\left(\frac{2}{3}, -\frac{8}{3}\right)$

d)  $(1, 0)$

4. a) no

b) yes

c) yes

d) no

e) yes

5. a)  $(0, 4)$

b)  $(0, 2)$

c)  $(3, 3)$

d)  $\left(\frac{1}{2}, \frac{1}{2}\right)$

6. infinite

7. zero (unless they can be simplified to have the same equation.)

8. zero

# Rearrange Equations into $y=mx+b$

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1. Solve for the variable indicated.

a)  $4x + y = 5$ ; solve for  $y$

b)  $4x + y = 5$ ; solve for  $x$

c)  $5x + 3y = 12$ ; solve for  $y$

d)  $5x + 3y = 12$ ; solve for  $x$

2. In each set of equations, identify the equation that is *not* equivalent to the others.

a)  $x + 2y = 1$ ;  $x - 1 = 2y$ ;

$$\frac{x}{2} + y = \frac{1}{2}; \frac{x}{4} + \frac{y}{2} = \frac{1}{4}$$

b)  $6a - 5b = 8$ ;  $3a - \frac{5}{2}b = 4$ ;

$$-6a + 5b = -8; a - \frac{5}{6}b = \frac{8}{5}$$

c)  $3m - n = 21$ ;  $m - \frac{n}{3} = 7$ ;

$$-n = 21 + 3m; 3m - 21 = n$$

d)  $-4 = 3y - 12x$ ;  $12x - 3y = -4$ ;

$$3x - \frac{3}{4}y = -1; 36x - 9y = -12$$

e)  $2m - 10n = 5$ ;  $4m - 10 = 20n$ ;

$$m - 5n = \frac{5}{2}; 2m + 5 = -10n$$

f)  $8a - b = 16$ ;  $4a - \frac{1}{2}b = 8$ ;

$$32a - 2b = 64; a - \frac{1}{8}b = 2$$

3. Solve for  $y$  in terms of  $x$ .

a)  $4y = 2 - 9x$

b)  $5x + 10y = 25$

c)  $3x - 8y = 13$

d)  $\frac{1}{4}x + \frac{3}{5}y = 2$

e)  $\frac{5}{2}x - \frac{2}{8}y = \frac{3}{4}$

f)  $5(y + 4) - 6x = 12$

g)  $2(y - 3) + 4(x + 3) = 3$

4. Solve the relation for the variable indicated.

a)  $6m - 2n = 11$ ; solve for  $m$

b)  $6m - 2n = 11$ ; solve for  $n$

c)  $6x - y = 2$ ; solve for  $y$

d)  $6x - y = 2$ ; solve for  $x$

e)  $2a + b = 0$ ; solve for  $a$

f)  $2a + b = 0$ ; solve for  $b$

5. In each set of equations, identify the equation that is *not* equivalent to the others.

a)  $15m - 10n = 1$ ;  $m - \frac{2}{3}n = \frac{1}{15}$ ;

$$5(m - 2n) = 1; 1 = 5(3m - 2n)$$

b)  $\frac{1}{6}x - 6y = 36$ ;  $x - 36y = 216$ ;

$$\frac{1}{3}x - 12y = 72; 36 - 6y = \frac{1}{6}x$$

c)  $2.5a - 5.0b = 10$ ;  $\frac{5}{2}a - \frac{10}{2}b = \frac{20}{2}$ ;

$$a - 2b = 5; 2.5a - 10 = 5.0b$$

d)  $\frac{8}{4}m - \frac{10}{4}n = \frac{12}{4}$ ;  $4m - 10n = 12$ ;

$$2m - 2.5n = 3; 8m - 10n = 12$$

e)  $3x - 6y = 18$ ;  $\frac{6}{2}x - \frac{12}{2}y = \frac{12}{2}$ ;

$$3(x - 2y) = 6; \frac{1}{2}(6x - 12y) = (12)\frac{1}{2}$$

f)  $100x - 200y = 300$ ;  $x - 2y = 3$ ;

$$\frac{1}{2}(2x - 4y) = 3; \frac{1}{2}(2x - 4y) = (3)\frac{1}{2}$$

6. Solve for  $y$  in terms of  $x$ .

a)  $10y = 3x - 4$

b)  $7.5x + 2.5y = 10$

c)  $\frac{1}{11}y - 11x = 1$

d)  $3(y - 12) + 4(x - 3) = 1$

e)  $\frac{8}{7}x - \frac{1}{7}y = 7$

f)  $\frac{4}{4}x - \frac{8}{8}y = 2$



# Answers: Rearrange Equations into $y=mx+b$

1. a)  $y = -4x + 5$

b)  $x = \frac{-y + 5}{4}$

c)  $y = \frac{-5x + 12}{3}$  or  $y = -\frac{5}{3}x + 4$

d)  $x = \frac{-3y + 12}{5}$

2. a)  $x - 1 = 2y$

b)  $a - \frac{5}{6}b = \frac{8}{5}$

c)  $-n = 21 + 3m$

d)  $-4 = 3y - 12x$

e)  $2m + 5 = -10n$

f)  $32a - 2b = 64$

3. a)  $y = \frac{-9x + 2}{4}$

b)  $y = \frac{-x + 5}{2}$

c)  $y = -\frac{-3x + 13}{8}$

d)  $y = \frac{-5x + 40}{12}$

e)  $y = 10x - 3$

f)  $y = \frac{6x - 8}{5}$

g)  $y = \frac{-4x - 3}{2}$

4. a)  $m = \frac{2n + 11}{6}$

b)  $n = -\frac{-6m + 11}{2}$

c)  $y = 6x - 2$

d)  $x = \frac{y + 2}{6}$

e)  $a = -\frac{b}{2}$

f)  $b = -2a$

5. a)  $5(m - 2n) = 1$

b)  $36 - 6y = \frac{1}{6}x$

c)  $a - 2b = 5$

d)  $4m - 10n = 12$

e)  $3x - 6y = 18$

f)  $\frac{1}{2}(2x - 4y) = (3)\frac{1}{2}$

6. a)  $y = \frac{3x - 4}{10}$

b)  $y = \frac{-7.5x + 10}{2.5}$

c)  $y = \frac{11x + 1}{11}$

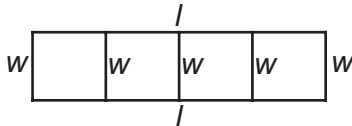
d)  $y = \frac{-4x + 49}{3}$

e)  $y = 8x - 49$

f)  $y = x - 2$

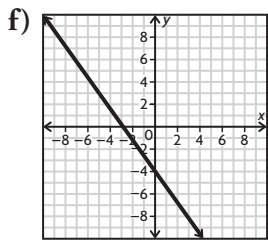
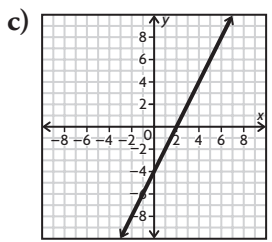
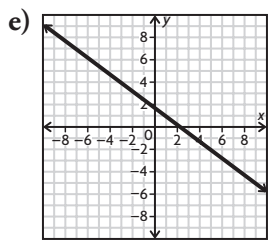
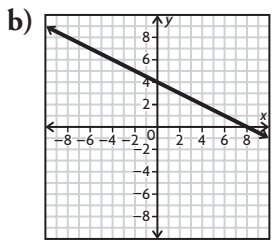
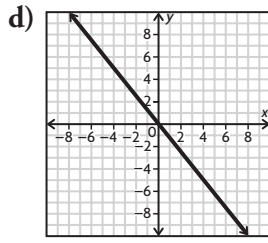
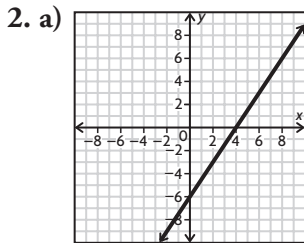
# Linear Equations: Rearrange and Represent

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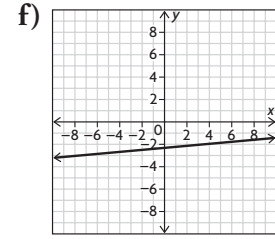
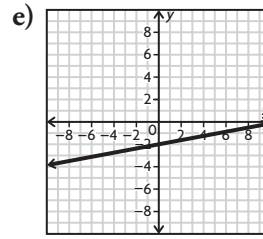
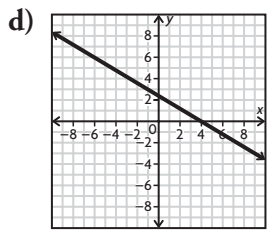
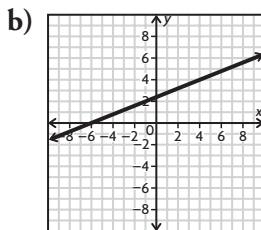
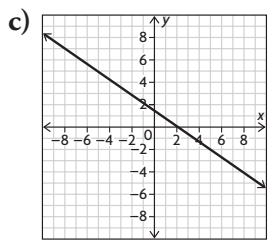
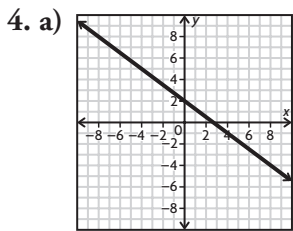
- Express each of the following equations in the form  $y = mx + b$ .
  - $3x - 2y = 12$
  - $2x + 4y = 16$
  - $4x - 2y - 8 = 0$
  - $5x + 4y = 0$
  - $6x + 8y - 14 = 0$
  - $3.5x + 2.5y = -10$
- Use the slope and  $y$ -intercept to sketch the graphs of each of the linear relations in Question 1.
- Without graphing, predict whether each of the following lines will rise or fall to the right. How do you know?
  - $3x + 4y = 8$
  - $2x - 5y + 12 = 0$
  - $4x + 5y - 9 = 0$
  - $3x + 5y = 12$
  - $1.5x - 8y = 16$
  - $\frac{x}{3} - 4y = 9$
- Check your predictions by graphing each line in Question 3.
- The dependent variable is  $d$  in each of the following equations. Isolate  $d$  to determine the  $d$ -intercept and the slope of each line.
  - $5t + 4d = 12$
  - $6d + 3h + 18 = 0$
  - $18 + 6k - 9d = 0$
  - $8r - 4d = 10$
  - $3d - 4a = 15$
  - $d + 6c - 9 = 0$
- The large rectangle below is formed from four identical rectangles as shown. The sum of the lengths of all the segments is 90 m.
  - Write an equation to represent the sum of the lengths.
  - Rearrange your equation to isolate one of the variables.
  - Graph the relationship.
  - Suggest three possible sets of dimensions for the large rectangle.
- Pierre's coin box contains 85 quarters and dimes. The coins have a total value of \$16.
  - Write one equation for the total number of coins and a second equation for the total value.
  - Graph both lines.
  - Determine the coordinates of the point of intersection of the lines.
  - How many quarters and how many dimes are in the box?
- Do  $y = \frac{1}{2}x + 3$  and  $2y - x = 6$  represent the same line? How do you know?
  - Show that  $2x - 3y + 4 = 0$  and  $y = -\frac{2}{3}x + \frac{4}{3}$  do not represent the same line.

# Answers: Linear Equations: Rearrange and Represent

1. a)  $y = \frac{3}{2}x - 6$       d)  $y = -\frac{5}{4}x$   
 b)  $y = -\frac{1}{2}x + 4$       e)  $y = -\frac{3}{4}x + \frac{7}{4}$   
 c)  $y = 2x - 4$       f)  $y = -1.4x - 4$



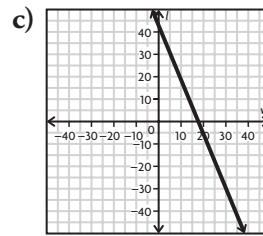
3. a) fall; slope is negative  
 b) rise; slope is positive  
 c) fall; slope is negative  
 d) fall; slope is negative  
 e) rise; slope is positive  
 f) rise; slope is positive



5. a)  $d = -\frac{5}{4}t + 3$ ;  $d$ -intercept: 3; slope:  $-\frac{5}{4}$   
 b)  $d = -\frac{1}{2}h - 3$ ;  $d$ -intercept: -3; slope:  $-\frac{1}{2}$   
 c)  $d = \frac{2}{3}k + 2$ ;  $d$ -intercept: 2; slope:  $\frac{2}{3}$   
 d)  $d = 2r - 2.5$ ;  $d$ -intercept: -2.5; slope: 2  
 e)  $d = \frac{4}{3}a + 5$ ;  $d$ -intercept: 5; slope:  $\frac{4}{3}$   
 f)  $d = -6c + 9$ ;  $d$ -intercept: 9; slope: -6

6. a)  $2l + 5w = 90$

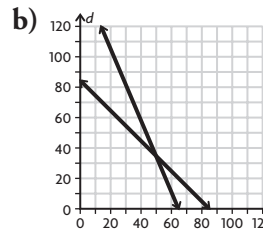
b)  $l = -\frac{5}{2}w + 45$  or  $w = -\frac{2}{5}l + 18$



d) Answers may vary; for example,

$w$	2	4	6
$l$	40	35	30

7. a)  $q + d = 85$ ;  $25q + 10d = 1600$



- c)  $(q, d) = (50, 35)$   
 d) 50 quarters, 35 dimes

8. a) Yes;  $2y - x = 6$  solved for  $y$  gives  $y = \frac{1}{2}x + 3$ .

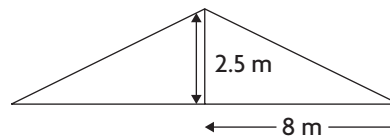
b)  $2x - 3y + 4 = 0$  solved for  $y$  gives  $y = \frac{2}{3}x + \frac{4}{3}$ ,  
 which is not equivalent to  $y = -\frac{2}{3}x + \frac{4}{3}$ .

# Linear Equations: Write equations given points.

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1. Calculate the slope of the line through each pair of points.
  - a)  $A(-3, 8)$  and  $B(2, -4)$
  - b)  $C(-2, 0)$  and  $D(2, 4)$
  - c)  $E(-1, 6)$  and  $F(-1, -2)$
  - d)  $G(-5, -2)$  and  $H(4, -2)$
  - e)  $I(5.5, 2.8)$  and  $J(2.5, 4.3)$
  - f)  $K(26, 580)$  and  $L(50, 868)$
2. Write the coordinates of one other point that would be on the line passing through the point  $B(3, 4)$  with each of the following slopes.
  - a)  $-\frac{1}{3}$
  - b)  $\frac{5}{2}$
  - c)  $-3$
  - d) undefined
  - e)  $0$
3. Determine whether the given points are collinear.
  - a)  $A(8, 0)$ ,  $B(5, 2)$ , and  $C(-4, -8)$
  - b)  $D(-2, 12)$ ,  $E(-8, 26)$ , and  $F(-32, 100)$
  - c)  $G(-20, -50)$ ,  $H(-5, -20)$ , and  $I(15, 20)$
  - d)  $J(-8, 2)$ ,  $K(-10, 6)$ , and  $L(1, -16)$
4.
  - a) Plot the points  $(-2, -6)$  and  $(4, -6)$  and draw the line that passes through them.
  - b) Calculate the slope of the line using the slope formula.
  - c) What can you conclude about the slope of a horizontal line?
5.
  - a) Plot the points  $(-2, 8)$  and  $(-2, -1)$  and draw the line that passes through them.
  - b) Calculate the slope of the line using the slope formula.
  - c) What can you conclude about the slope of a vertical line?

6. Determine whether the line passing through each pair of points is horizontal, vertical, or slanted.
  - a)  $A(5, 2)$  and  $B(2, 5)$
  - b)  $C(-6, 4)$  and  $D(6, -4)$
  - c)  $E(5, -9)$  and  $F(5, 3)$
  - d)  $G(8, 6)$  and  $H(-1, 6)$
7. Determine the value of  $k$  in the line passing through points  $S(-2, 6)$  and  $T(-4, k)$  if the slope of the line is  $2$ .
8. The slope of the line passing through points  $P(3, -2)$  and  $Q(k, 6)$  is  $\frac{2}{3}$ . Determine the value of  $k$ .
9. The roof of a house is being designed to have a slope of  $\frac{1}{4}$  or greater.
  - a) Does the roof design shown below meet the requirement?



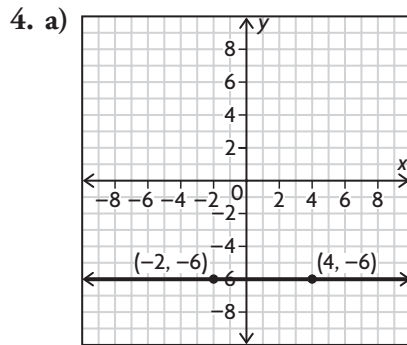
- b) What is the greatest length that could be used for a height of  $2.5$  m?
10. A pool is being emptied at a constant rate. After  $5$  minutes the water is  $2.4$  m deep, and after  $10$  minutes the water is  $2.1$  m deep. At what rate is the depth of water decreasing?

# Answers: Linear Equations: Write equations given points.

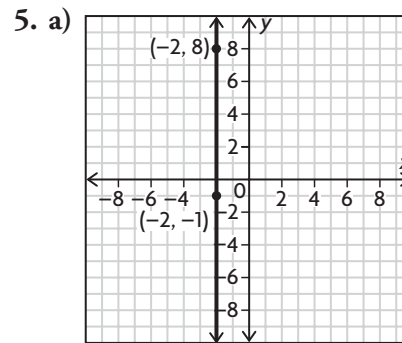
1. a)  $-\frac{12}{5}$       d) 0  
 b) 1              e)  $-\frac{1}{2}$   
 c) undefined    f) 12

2. a) Answers may vary; for example, (6, 3).  
 b) Answers may vary; for example, (1, -1).  
 c) Answers may vary; for example, (4, 1).  
 d) Answers may vary; for example, (3, 6).  
 e) Answers may vary; for example, (1, 4).

3. a) No  
 b) No  
 c) Yes  
 d) yes



- b) 0  
 c) The slope of a horizontal line is 0.



- b) undefined  
 c) The slope of a vertical line is undefined.
6. a) slanted  
 b) slanted  
 c) vertical  
 d) horizontal

7. 2

8. 15

9. a) Yes  
 b) 10 m

10. The depth of the water is decreasing by 0.06 m/min, or 6 cm/min.

# Linear Equations: Write equations with conditions 1

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If the equation  $y = 2x + b$  represents a line that passes through the point  $(3, 1)$ , determine the value of the  $y$ -intercept.

$$y = 2x + b$$

Replace  $x$  with 3 and  $y$  with 1 and solve for  $b$ .

$$3 = 2(1) + b$$

$$3 = 2 + b$$

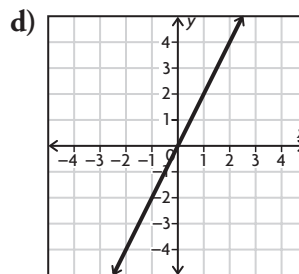
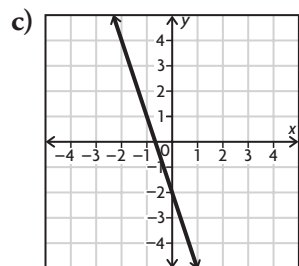
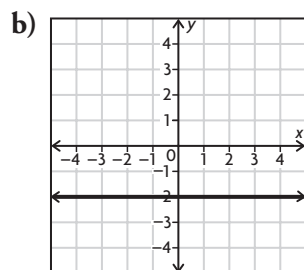
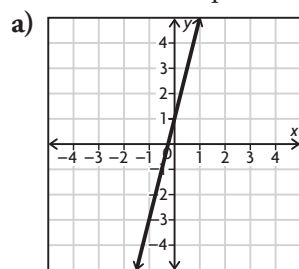
$$1 = b$$

The  $y$ -intercept is 1.

1. Complete the table shown below by determining the missing values.

	Slope	$y$ -intercept	Equation
a)	4	-2	
b)			$y = \frac{1}{3}x + 4$
c)	$-\frac{1}{2}$	3	
d)			$y = x$

2. Determine the equation of each line shown below.



3. If the equation  $y = 4x + b$  represents a line that passes through the given point, determine the value of the  $y$ -intercept,  $b$ .
- a)  $(3, 1)$       b)  $(-2, 4)$       c)  $(3, -3)$
4. If the equation  $y = mx - 2$  represents a line that passes through the given point, determine the slope value,  $m$ .
- a)  $(1, 2)$       b)  $(-2, 6)$       c)  $(6, 1)$
5. Determine the equation of each line described below.
- a) passing through the point  $A(0, 3)$ , with a slope of  $-\frac{4}{5}$
- b) passing through the point  $A(6, -1)$  with a slope of  $\frac{1}{3}$
- c) has an  $x$ -intercept of  $-2$  and a  $y$ -intercept of  $4$
- d) has an  $x$ -intercept of  $5$  and passes through the point  $(5, 4)$
6. Determine the equation of the line passing through each pair of points.
- a)  $A(4, 8)$  and  $B(4, -2)$
- b)  $C(-3, 1)$  and  $D(3, 4)$
- c)  $E(3, 6)$  and  $F(-2, 6)$
- d)  $G(4, 8)$  and  $H(-3, -6)$
- e)  $I(0, 4)$  and  $J(0, -5)$
- f)  $K(12, 2)$  and  $L(-4, -2)$
7. Determine the equation of the line that has the same  $x$ -intercept as the line described by  $x - y + 4 = 0$ , and the same  $y$ -intercept as the line  $2x + 4y - 8 = 0$ .

# Answers: Linear Equations: Write equations with conditions 1

1.

	Slope	y-intercept	Equation
a)	4	-2	$y = 4x - 2$
b)	$\frac{1}{3}$	4	$y = \frac{1}{3}x + 4$
c)	$-\frac{1}{2}$	3	$y = -\frac{1}{2}x + 3$
d)	1	0	$y = x$

2. a)  $y = 4x + 1$   
 b)  $y = -2$   
 c)  $y = -3x - 2$   
 d)  $y = 2x$

3. a) -11  
 b) 12  
 c) -15

4. a) 4  
 b) -4  
 c)  $\frac{1}{2}$

5. a)  $y = -\frac{4}{5}x + 3$

b)  $y = \frac{1}{3}x - 3$

c)  $y = 2x + 4$

d)  $x = 5$

6. a)  $x = 4$

b)  $y = \frac{1}{2}x + \frac{5}{2}$

c)  $y = 6$

d)  $y = 2x$

e)  $x = 0$  ( $y$ -axis)

f)  $y = \frac{1}{4}x - 1$

7.  $y = \frac{1}{2}x + 2$

# Linear Equations: Write equations with conditions 2

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1. For each pair of equations, state whether the lines are parallel, perpendicular, or neither.

a)  $y = 3x - 2$

$$y = -\frac{1}{3}x + 2$$

b)  $y = \frac{3}{4}x + 3$

$$y = -1.5x + 3$$

c)  $y = \frac{2}{3}x - 5$

$$y = -\frac{2}{3}x - 5$$

d)  $x + 3y = 4$

$$2x + 6y = -8$$

e)  $y = -0.4x + 2$

$$y = -\frac{2}{5}x - 1$$

f)  $x - 2y + 4 = 0$

$$2x - y = 0$$

2. The following sets of points are the endpoints of line segments. Determine which line segments are parallel and which line segments are perpendicular.

A(-6, 4) and B(2, 12)

S(-3, 8) and T(3, 2)

F(-4, -2) and G(4, 6)

3. Are the lines defined by the equations  $y = 3$  and  $y = -3$  parallel, perpendicular, or neither? Explain.

4. a) Write the equation of a line perpendicular to the  $x$ -axis that passes through the point (2, 6).

- b) Write the equation of a line perpendicular to the  $x$ -axis that passes through the point (-2, -4).

- c) In general, what is true about the equation of any line perpendicular to the  $x$ -axis?

5. a) Write the equation of a line perpendicular to the  $y$ -axis that passes through the point (1, 5).

- b) Write the equation of a line perpendicular to the  $y$ -axis that passes through the point (-4, -6).

- c) In general, what is true about the equation of any line perpendicular to the  $y$ -axis?

6. Use the given information to write the equation of each line.

- a) a line parallel to the line defined by  $y = 2x + 4$  and passing through the point (2, -4)

- b) a line perpendicular to the line defined by  $y = 2x + 4$  and passing through the point (2, -4)

- c) a line parallel to the line defined by  $2x + 2y = 6$  with  $y$ -intercept = 2

- d) a line perpendicular to the line defined by  $2x - 4y + 12 = 0$  with the same  $y$ -intercept

7. Determine the equation of a line perpendicular to  $3x - 2y - 1 = 0$  with the same  $y$ -intercept as the line defined by  $2x + 3y = -9$ .

8. Determine the equation of a line perpendicular to  $2x + 4y - 8 = 0$  with the same  $x$ -intercept as the line defined by  $4x + 3y = -12$ .

9. For the given vertices, determine whether or not ABC is a right triangle.

a) A(-5, 0), B(0, 6), and C(6, 1)

b) A(-1, 3), B(2, 9), and C(3, 1)



## Answers: Linear Equations: Write equations with conditions 2

1. a) perpendicular  
b) neither  
c) neither  
d) parallel  
e) parallel  
f) neither
2. AB is parallel to FG;  $ST \perp AB$ ;  $ST \perp FG$
3. parallel; both lines are parallel to the  $x$ -axis, so they are parallel to each other
4. a)  $x = 2$   
b)  $x = -2$   
c) It is a vertical line equation and has the form  $x = x$ -coordinate of the point through which it passes.
5. a)  $y = 5$   
b)  $y = -6$   
c) It is a horizontal line equation and has the form  $y = y$ -coordinate of the point through which it passes.
6. a)  $y = 2x - 8$   
b)  $y = -\frac{1}{2}x - 3$   
c)  $y = -x + 2$   
d)  $y = -2x + 3$
7.  $y = -\frac{2}{3}x - 3$
8.  $y = 2x + 6$
9. a) Yes  
b) No

# Translating Words to Algebra

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## Number Problems

1. a) Five times a number, increased by 3, is 85. Determine the number.
- b) Seven times a number, decreased by 11, is 129. Determine the number.
- c) Determine three consecutive numbers with a sum of 426.
- d) Determine three consecutive even numbers with a sum of 252.
- e) The sum of two numbers is 125. Five times one number minus three times the other is 41. Determine the numbers.
- f) Two numbers have a difference of 123. The larger number is 22 more than twice the smaller. Determine the numbers.
- g) The sum of two numbers is 249. Twice the larger plus 3 times the smaller is 591. Determine the numbers.
- h) The sum of two numbers is 46. When 30 is subtracted from 5 times the smaller the result is 3 times the larger. Determine the numbers.

## Age Problems

2. a) Don is three times as old as David and the sum of their ages is 52. Determine their ages.
- b) Sue's mother is 22 years older than her and the sum of their ages is 60. Determine their ages.
- c) Karen is twice as old as Lori. Three years from now the sum of their ages will be 42. How old is Karen?
- d) Frank is eight years older than his sister. In three years from now he will be twice as old as she is. How old are they now?
- e) John is three times as old as Mary and the sum of their ages is 24. Determine their ages.
- f) One-half of Peter's age two years from now plus one-third of his age three years ago is 20. How old is Peter?
- g) Sam's father is 3 times as old as he is. In six years the sum of their ages will be 68. How old is Sam?
- h) Paul's age is six less than twice Lucien's age. Two years ago, the sum of their ages was 29. How old is Lucien?
- i) The sum of Mary's age and Sally's age is 41 years. Five years from now the sum of their ages will be three times Mary's present age. How old is Mary now?

## Money Problems:

3. a) Sam sells cookies and milk at the exhibition. He has \$10.65 made up of dimes and quarters. Of there are 54 coins in all, how many dimes are there?
- b) A bill of \$2.35 was paid in dimes and nickels. If there were 32 coins in all, how many dimes were there?
- c) Mary bought a radio for \$120. She paid for it with two-dollar coins and five-dollar bills. If there was a total of 30 coins and bills in all, how many were there of each?

## Translating Words to Algebra (continued)

- d) Jeff has \$3.15 made up of nickels and dimes. If he has five times as many nickels as dimes, how many dimes does he have?
- e) Ron has \$21.90 made up of dimes and quarters. If there are 117 coins in all, how many quarters are there?
- f) Pete has twice as many \$2 bills as he has \$5 bills. In total he has \$153. How many \$5 bills does he have?
- g) Mary has \$300 made up of \$5 and \$10 bills. If there are 39 bills in all, how many \$5 bills does she have?
- h) A parking meter contained 78 coins made up of dimes and nickels. The total value of the coins was \$5.20. How many dimes did it contain?

### Other Problems:

4. a) The length of a rectangle is 7m longer than the width. If the perimeter of the rectangle is 194m, what are the dimensions of the rectangle?
- b) To find the length of a certain rectangle you must triple the width and add 5m. If the perimeter of the rectangle is 74m, Determine the dimensions.
- c) During his major league career, Hank Aaron hit 31 more home runs than Babe Ruth. Together they hit 1459 home runs. How many home runs did Babe Ruth hit?
- d) At a fast food restaurant, a milk shake costs twice as much as an order of french fries. If two milk shakes and three orders of french fries cost \$4.20, what is the cost of a milk shake?

### Challenge Problems

5. a) A large billboard has a length measuring 5 metres less than triple its width. The perimeter of the billboard is 110 m. What is the width of the billboard?
- b) A piggy bank contains \$18.30 made up of loonies, quarters and nickels. There are 3 more quarters than loonies and twice as many nickels as loonies. How many of each coin are there?
- c) On a test, some problems were worth 5 marks and others were worth 4 marks. Andrew solved 18 problems and got a mark of 83. How many 5-mark problems did he solve?
- d) The least of three consecutive integers is divided by 5, the next by 3, and the greatest is divided by 4. What are the numbers if the sum of the quotients is 40?
- e) George's teacher refused to reveal her age. After being begged for a hint she finally admitted that in 12 years she would be three times as old as she was 20 years ago. How old is she?
- f) A piggy bank contains 91 coins which are nickels, dimes, and quarters. There are twice as many quarters as dimes, and half as many nickels as dimes. How much is in the piggy bank?

### Answers:

- |                |                          |                        |               |               |             |
|----------------|--------------------------|------------------------|---------------|---------------|-------------|
| 1. a) 16.4     | b) 20                    | c) 141, 142, 143       | d) 82, 84, 86 | e) 52, 73     |             |
| f) 101, 224    | g) 93, 156               | h) 21, 25              |               |               |             |
| 2. a) 13, 39   | b) 19, 41                | c) 12, 24              | d) 5, 13      | e) 6, 18      | f) 24 years |
| g) 14, 42      | h) 13, 20                | i) 17, 24              |               |               |             |
| 3. a) 19       | b) 15                    | c) 10 \$2, 20 \$5      | d) 9 dimes    | e) 68         | f) 17       |
| g) 18          | h) 26                    |                        |               |               |             |
| 4. a) 45m, 52m | b) 29m, 8m               | c) 714                 | d) \$1.20     |               |             |
| 5. a) 15m, 40m | b) 13 \$1, 16 25¢, 26 5¢ | c) 11 5-mark, 7 4-mark |               | d) 50, 51, 52 |             |
| e) 36          | f) \$16.25               |                        |               |               |             |