## Equations

1.  How do you solve equations?

2.  What do you do when an equation has variables on both sides?

3.  How do you transform equations?  Why would you want to?

## Equations with the Same Variable on Both Sides

**Classwork**

Solve.

1) $18 - 5t = t$

2) $3m - 6 = 5m + 8$

3) $22w - 42 = 34 - 16w$

4) $r + 6 - 5r = 14 - 2r$

5) $6x + 12 = 4x$

6) $4n - 4 = -16n + 26$

7) $y - 2y + 3 = 3 - y$

8) $4u - 7 = u + 3(4 + u)$

9) $4m - (8 - m) = 6 - 2m$

10) $3b + 16 = 5b + 16 - 2b$

11) $\frac{1}{6}(6w - 12) = 6 - 2(w - 2)$

12) $6(6 - 2a) = -27a - \frac{3}{2}(-4a + 6)$

13) $2b + 4(b - 6) = -2(2b - 14) + 98$

14) $4g + 3(g - 2) = -5(g - 4) - g - 26$

15) $-7 + 8(5 - 3s) = 3(7 - 9s)$

16) The sum of the ages of the three Romano brothers is 63. If their ages can be represented as consecutive integers, what is the age of the middle brother?[1]

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**Homework**

Solve.

17) $2m = 24 + 3m$

18) $5w - 17 = 12 - 5w$

19) $2p - 9 = 5p + 12$

20) $35 - y = 4y$

21) $10x = 4x - 8x + 7$

22) $2s + 16 = s - 25$

23) $14 - (2c + 5) = -2c + 9$

24) $20 - 16p = 4(5 - 4p)$

25) $4n + 8 = 8 - 4n$

26) $1.4h = 1.8h + 4.8 - 0.4h$

27) $\frac{2}{3}(9x - 15) = 17 - 3(x - 12)$

28) $2(3x - 4) = -2x + 40$

29) $3(1 + 2x) - 4x = -(x + 30)$

30) $8g + 6(g - 2) = -10(g - 4) - 2g$

31) $12(3n - 7) + 8n = -2(4 - 3n)$

32) Arielle has a collection of grasshoppers and crickets. She has 561 insects in all. The number of grasshoppers is twice the number of crickets. Find the number of *each* type of insect that she has.

## Literal Equations

**Classwork**

33) Solve for $w$.  $A = lw$

34) Solve for $m$.  $t = \frac{v+m}{3}$

35) Solve for $b$.  $16c - 10b = 2$

36) Solve for $h$. $A = \frac{1}{2}bh$

37) Solve for $r$.  $V = \frac{4}{3}\pi r^3$

**Homework**

38) Solve for $l$.  $P = 2l + 2w$

39) Solve for $c$. $p = \frac{b+c}{5}$

40) Solve for $s$.  $20x - 5s = 8$

41) Solve for $h$.  $V = 2\pi r^2 h$

42) Solve for $h$.  $A = \frac{1}{2}(b_1 + b_2)h$

43) The formula for the volume of a right circular cylinder is $V = \pi r^2 h$.

The value of $h$ can be expressed as:

a. $\frac{V}{\pi}r^2$
b. $\frac{V}{\pi r^2}$
c. $\frac{\pi r^2}{V}$
d. $V - \pi r^2$

44) If $c = 2m + d$, then $m$ is equal to:

   a) $\frac{c-d}{2}$

   b) $\frac{c}{2} - d$

   c) $c - \frac{d}{2}$

   d) $d - 2$

## <u>Substituting Values into an Equation</u>

## Classwork

Use the distance formula, $d = rt$, to find the distance traveled

45) Rate: 40 mph; Time: 2 hrs

46) Rate: 60 mph; Time: 5 hrs

47) Rate: 34 mph; Time: ½ hr

48) Riding downhill on your bike you accelerate from $6 \text{ m/s}$ to $10 \text{ m/s}$ over 7 seconds. What is your acceleration?

$$a = \frac{(v - v_0)}{t}$$

49) A particle traveled 55 meters at a speed of $22 \text{ m/s}$.

   a) Solve the equation $s = \frac{d}{t}$ for the time.

   b) How long did it take the particle to travel the 55 meters?

50) The surface area of a rectangular prism is $220 \text{ cm}^2$, its length is $10 \text{ cm}$, and its height is $4 \text{ cm}$.

   a) Solve the equation $S = 2\ell w + 2wh + 2\ell h$ for the width.

   b) What is the width of the rectangular prism?

51) The volume of a cylinder is $80\pi$ cm³, and its radius is 4 cm.
   a) Solve the equation $V = \pi r^2 h$ for the height.



   b) What is the height of the cylinder?



**Homework**

Use the distance formula, $d = rt$, to find the distance traveled

52) Rate: 14 mph; Time: 2 hrs

53) Rate: 60 mph; Time: ¾ hrs

54) Rate: 40 mph; Time: ½ hr



55) Climbing a mountain pass on your bike you decelerate from 6 m/s to 3 m/s over 45 seconds. What is your acceleration?
$$a = \frac{(v - v_0)}{t}$$



56) The force acting on an object is 50 Newtons, and the objects mass is 24 kg.
   a) Solve the equation $F = ma$ for the acceleration.



   b) What is the acceleration acting on the object?



57) The surface area of a cone $150\pi$ cm², and its radius is 5 cm.
   a) Solve the equation $S = \pi r^2 + \pi r\ell$ for the slant height, $\ell$.



   b) What is the slant height of the cone?

58) The volume of a square-based pyramid is $90 \text{ cm}^3$, and the side length of its base is 5 cm.

a) Solve the equation $V = \frac{1}{3}s^2h$ for the height.

b) What is the height of the pyramid?

59) A particle decreased its speed from $90 \text{ m/s}$ to $30 \text{ m/s}$ in with an acceleration of $-4 \text{ m/s}^2$.

a) Solve the equation $v = v_o + at$ for the time.

b) How much time did it take for the particle to decrease its speed?

# Unit Review

1. Solve the equation: $-3(2u + 5) + 3.5u = -u$
   a. $u = 10$
   b. $u = -10$
   c. $u = 4$
   d. $u = -4$

2. Solve the equation: $-4a = 14a - 12(4a + 10)$
   a. $a = 10$
   b. $a = 4$
   c. $a = -4$
   d. $a = -10$

3. Solve the equation: $2(x + 6) = 2(-x + 6.5)$
   a. $x = 13$
   b. $x = 0.4$
   c. $x = 4$
   d. $x = 1/4$

4. Solve the equation: $5t = 2 - t$
   a. $t = -6$
   b. $t = -1/3$
   c. $t = 1/3$
   d. $t = 6$

5. Determine the correct methods for solving the equation $x = \frac{6}{7}(y + 28)$ for y.
   Select all that apply.

   a) $\left(\frac{6}{7}\right)x = \left[\frac{6}{7}(y + 28)\right]\left(\frac{6}{7}\right)$
   $$\frac{6}{7}x = y + 28$$
   $$\underline{-28 \qquad - 28}$$
   $$\frac{6}{7}x - 28 = y$$

   b) $\left(\frac{7}{6}\right)x = \left[\frac{6}{7}(y + 28)\right]\left(\frac{7}{6}\right)$
   $$\frac{7}{6}x = y + 28$$
   $$\underline{-28 \qquad - 28}$$
   $$\frac{7}{6}x - 28 = y$$

   c) $\left(\frac{7}{6}\right)x = \left[\frac{6}{7}(y + 28)\right]\left(\frac{7}{6}\right)$
   $$\frac{7}{6}x = y + 28$$
   $$\underline{+28 \qquad + 28}$$
   $$\frac{7}{6}x + 28 = y$$

   d) $x = \frac{6}{7}(y + 28)$
   $$x = \frac{6}{7}y + 24$$
   $$\underline{-24 \qquad - 24}$$
   $$\left(\frac{6}{7}\right)[x - 24] = \left[\frac{6}{7}y\right]\left(\frac{6}{7}\right)$$
   $$\frac{6}{7}x - \frac{144}{7} = y$$

   e) $x = \frac{6}{7}(y + 28)$
   $$x = \frac{6}{7}y + 24$$
   $$\underline{+24 \qquad + 24}$$
   $$\left(\frac{7}{6}\right)[x + 24] = \left[\frac{6}{7}y\right]\left(\frac{7}{6}\right)$$
   $$\frac{7}{6}x + 28 = y$$

   f) $x = \frac{6}{7}(y + 28)$
   $$x = \frac{6}{7}y + 24$$
   $$\underline{-24 \qquad - 24}$$
   $$\left(\frac{7}{6}\right)[x - 24] = \left[\frac{6}{7}y\right]\left(\frac{7}{6}\right)$$
   $$\frac{7}{6}x - 28 = y$$

Solve the equation.

   6.  $-6(2m + 1) = 3m + 54$

   7.  $2x - 4 - 2x = -(8x + 2)$

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

   9.  $\frac{1}{6}c + 0.5 = -\frac{5}{6}c + 1$

   10. $\frac{3}{4}(12x - 20) = \frac{1}{8}x + \frac{11}{4}$

Solve each equation for the desired variable
   11. $w = 7d + e;$  solve for $d$

   12. $V = \frac{1}{3}\pi r^2 h;$  solve for $h$

   13. $S = 2\ell w + 2wh + 2\ell h;$  solve for $\ell$

   14. $h = -16t^2 + vt + s;$  solve for $v$

   15. The surface area of a cylinder $420\pi$ cm$^2$, and its radius is $10$ cm.
      a.  Solve the equation $S = 2\pi r^2 + 2\pi r h$ for the height.

      b.  What is the height of the cylinder?

16. The temperature can be converted from Fahrenheit to Celsius using the equation $C = \frac{5}{9}(F - 32)$.

    a. Determine the equation required to convert from Celsius to Fahrenheit.


    b. If you are on vacation in Alicanté, Spain and the temperature for the day is $35°C$, what is the temperature in degrees Farenheit? How should you dress? Explain your answer.

## Answer Key

1. $t = 3$
2. $m = -7$
3. $w = 2$
4. $r = -4$
5. $x = -6$
6. $n = 3/2$
7. All Real Numbers/infinite solutions
8. No Solution
9. $m = 2$
10. All Real Numbers/infinite solutions
11. $w = 4$
12. $a = -5$
13. $b = 15$
14. $g = 0$
15. $s = -4$
16. 21 years old
17. $m = -24$
18. $w = 2.9 \ or \ 29/10$
19. $p = -7$
20. $y = 7$
21. $x = \frac{1}{2}$
22. $s = -41$
23. All Real Numbers/infinite solutions
24. All Real Numbers/infinite solutions
25. $n = 0$
26. No Solution
27. $x = 7$
28. $x = 6$
29. $x = -11$
30. $g = 2$
31. $n = 2$
32. Crickets: 187; Grasshoppers: 374
33. $w = \frac{A}{l}$
34. $m = 3t - v$
35. $b = \frac{16c - 2}{10}$
36. $h = \frac{2A}{b}$
37. $r = \sqrt[3]{\frac{3V}{4\pi}}$
38. $l = \frac{P - 2w}{2}$

39. $c = 5p - b$
40. $s = \frac{20x - 8}{5}$
41. $h = \frac{V}{2\pi r^2}$
42. $h = \frac{2A}{b_1 + b_2}$
43. b
44. a
45. 80 miles
46. 300 miles
47. 17 miles
48. $a = 0.\overline{571428} \ \frac{m}{s^2} \ or \ a = \frac{4}{7} m/s^2$
49.
   a. $t = \frac{d}{s}$
   b. $t = 2.5$ seconds
50.
   a. $w = \frac{S - 2\ell h}{2\ell + 2h}$
   b. $w = 5$ cm
51.
   a. $h = \frac{V}{\pi r^2}$
   b. $h = 5$ cm
52. 28 miles
53. 45 miles
54. 20 miles
55. $a = -0.0\overline{6} \ \frac{m}{s^2}$
56.
   a. $a = \frac{F}{m}$
   b. $a = 2.08\overline{3} \ \frac{N}{kg} \ or \ a = \frac{25}{12} \frac{N}{kg}$
57.
   a. $\ell = \frac{S - \pi r^2}{\pi r}$
   b. $\ell = 25 \ cm$
58.
   a. $h = \frac{3V}{s^2}$
   b. $h = 10.8$ cm
59.
   a. $t = \frac{v - v_o}{a}$
   b. $t = 15$ seconds

**Unit Review Answer Key**

1. B
2. C
3. D
4. C
5. B & F
6. $m = -4$
7. $x = \frac{1}{4}$
8. $x = -\frac{17}{4}$
9. $c = 0.5$

10. $x = 2$
11. $d = \frac{w-e}{7}$
12. $h = \frac{3V}{\pi r^2}$
13. $\ell = \frac{S-2wh}{2w+2h}$
14. $v = \frac{16t^2+h-s}{t}$
15. a) $h = \frac{S-2\pi r^2}{2\pi r}$
    b) $h = 11cm$

16. a) $F = \frac{9}{5}C + 32$

    b) $F = 95°F$;
    <u>Sample Answer</u>: A T-shirt and shorts would be appropriate since the temperature is so high.