Elementary Algebra Diagnostic Test

Mathematics Department

January 26, 2004

Instructions: Click the "Begin Assessment" button before you begin your selections. For each question, click the checkbox containing the "best" answer to the question. When you complete the assessment, click the "End Assessment" button with your mouse to obtain your results.

You can also obtain corrections to the assessment by clicking the "Correct" button. Answers are marked according to the following legend.

Legend: A ✔ indicates that the assessment-taker gave the correct response. A ✘ indicates an incorrect response. In this case, the correct answer is marked with a ●. You can examine solutions by clicking the correct answer marker ●.

Begin Assessment

1. $2a - 3c - 6a + 11c =$

- ☐ $4a - 8c$
- ☐ $-12a - 33c$
- ☐ $5a - c$
- ☐ $-4a + 8c$
- ☐ $-8a + 4c$

2. $\sqrt{3}\sqrt{6} =$

- ☐ $2\sqrt{3}$
- ☐ 9
- ☐ $3\sqrt{2}$
- ☐ $2\sqrt{6}$
- ☐ $6\sqrt{2}$

3. $(x^2)^5 =$

- ☐ x^7
- ☐ x^{32}
- ☐ x^{25}
- ☐ $x^{5/2}$
- ☐ x^{10}

4. If $x - \frac{3}{5}x = 4$, then $x =$

- ☐ 5
- ☐ 10
- ☐ 4
- ☐ 6
- ☐ 3

5. $(x + 2y)^2 =$

- ☐ $x^2 + 4y^2$
- ☐ $x^2 + 2xy + 4y^2$
- ☐ $x^2 + 4xy + 4y^2$
- ☐ $x^2 + xy + 2y^2$
- ☐ $4xy^2$

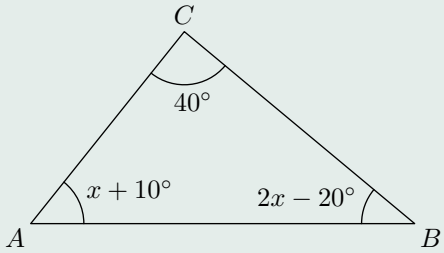
6. $5^{-3} =$

- ☐ -15
- ☐ -125
- ☐ $1/125$
- ☐ $-1/243$
- ☐ -8

7. A circle having diameter 12 inches has area equalling

- ☐ 36π in^2
- ☐ 18π in^2
- ☐ 144π in^2
- ☐ 12π in^2
- ☐ 24π in^2

8. In triangle $\triangle ABC$, what is the degree measure of angle $\angle A$? *Note: Do not assume figure is drawn to scale.*



- ☐ $30°$
- ☐ $40°$
- ☐ $50°$
- ☐ $60°$
- ☐ $70°$

9. $\dfrac{a^3b^6}{a^5b^2} =$

- ☐ $\dfrac{a^2}{b^4}$
- ☐ $\dfrac{b^4}{a^2}$
- ☐ a^8b^8
- ☐ a^2b^4
- ☐ $\dfrac{1}{a^2b^4}$

10. One of the solutions of

$$(ax + b)(cx + d) = 0$$

is

- ☐ $-a/b$
- ☐ $-c/d$
- ☐ $-ab$
- ☐ $-cd$
- ☐ $-d/c$

11. $2x^3(x^2 - 3xy + y^2) =$

- ☐ $2x^6 - 6x^3y + 2x^3y^2$
- ☐ $2x^5 - y^3$
- ☐ $2x^5 - 6x^3y + y^2$
- ☐ $2x^5 - 6x^4y + y^2$
- ☐ $2x^5 - 6x^4y + 2x^3y^2$

12. One of the factors of $6x^2 + x - 12$ is

- ☐ $3x + 4$
- ☐ $2x - 3$
- ☐ $6x - 1$
- ☐ $2x + 3$
- ☐ $x + 6$

13. If $a = 3$ and $b = -2$, then $-a^3b^2 =$

- ☐ -108
- ☐ 108
- ☐ 54
- ☐ -36
- ☐ 64

14. $\frac{2}{3} - \frac{4}{5} =$

- ☐ -1
- ☐ -2
- ☐ $-2/15$
- ☐ $-8/15$
- ☐ $-2/5$

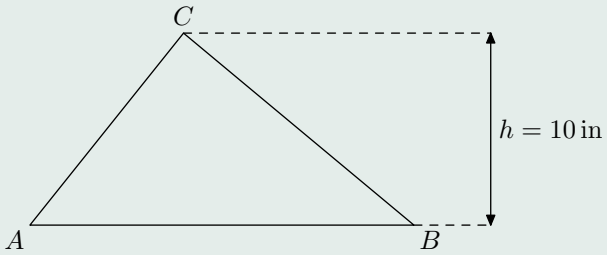
15. If

$$x + y = 4$$
$$2x - y = 6,$$

then $y =$

- ☐ $10/3$
- ☐ $2/3$
- ☐ $-5/3$
- ☐ $4/3$
- ☐ $7/3$

16. In triangle $\triangle ABC$,

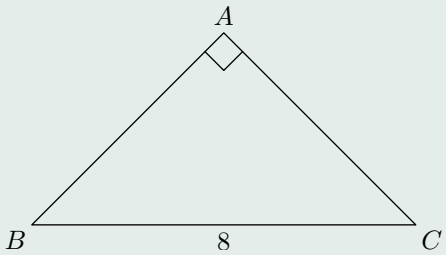


if $AB = 12$, then the area of triangle $\triangle ABC$ is

☐ 60 ☐ 80 ☐ 120

☐ 140 ☐ 200

17. Right triangle $\triangle ABC$ is isosceles; that is, $AB = AC$. Fnd the length of AB.



☐ 4 ☐ 8 ☐ $3\sqrt{2}$

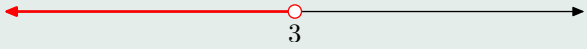
☐ $2\sqrt{2}$ ☐ $4\sqrt{2}$

18. Thirty-two is four-fifths of what number?

☐ 20 ☐ 30 ☐ 40

☐ 50 ☐ 60

19. Which of the following sets (depicted in red) best describe the set of all x such that $x \leq 3$?

☐ 

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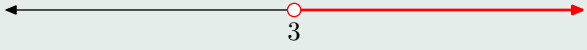
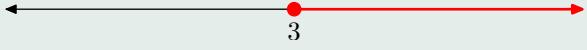
☐ 

☐ 

20. What percent of 8 is 12?

☐ $66\frac{2}{3}\%$ ☐ 80% ☐ 60%

☐ 150% ☐ 125%

21. $\sqrt{32} - \sqrt{8} =$

☐ $2\sqrt{6}$ ☐ $3\sqrt{2}$ ☐ $2\sqrt{3}$

☐ $4\sqrt{2}$ ☐ $2\sqrt{2}$

22. $4x^2 - 9 =$

- ☐ $(2x-3)^2$
- ☐ $(2x+3)^2$
- ☐ $(2x+3)(x-3)$
- ☐ $(x+3)(2x-3)$
- ☐ $(2x+3)(2x-3)$

23. Solve $I = Prt$ for r.

- ☐ $I - Pt$
- ☐ $\dfrac{Pt}{I}$
- ☐ $\dfrac{I}{Pt}$
- ☐ $I + Pt$
- ☐ $(I+P)t$

24. If $\dfrac{12}{18} = \dfrac{3}{x}$, then $x =$

- ☐ $3/4$
- ☐ $2/3$
- ☐ $3/2$
- ☐ $5/2$
- ☐ $9/2$

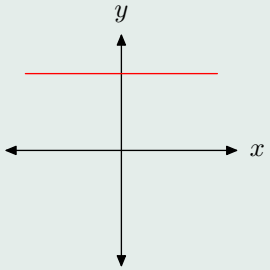
25. A rectangular box has a square base and height 8 inches. If the volume of the box is 50 cubic inches, find the dimensions of the base.

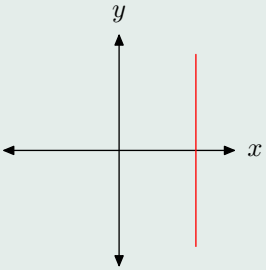
- ☐ 2.5 inches
- ☐ 1.5 inches
- ☐ 1.75 inches
- ☐ 2.25 inches
- ☐ 3.5 inches

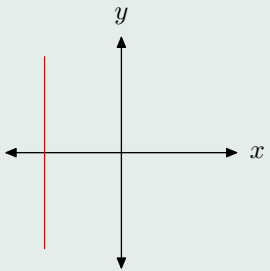
26. If $\dfrac{x}{x-1} = 4$, then $x =$

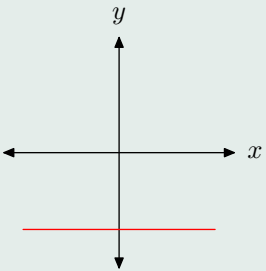
- ☐ $4/3$
- ☐ $3/4$
- ☐ $4/5$
- ☐ $5/4$
- ☐ $-2/3$

27. Which of the following best depicts the graph of $x = -4$?









28. If $a = 2$ and $b = -3$, then $\dfrac{2a - 3b}{a + 2b} =$

- ☐ $14/5$
- ☐ $-12/5$
- ☐ $-13/4$
- ☐ $-11/4$
- ☐ $15/2$

29. $\sqrt{48} =$

- ☐ $3\sqrt{4}$
- ☐ $2\sqrt{3}$
- ☐ $3\sqrt{2}$
- ☐ $2\sqrt{6}$
- ☐ $4\sqrt{3}$

30. $(x^2 - 2x - 3) - (-2x^2 + x - 4) =$

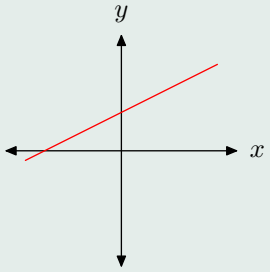
- ☐ $3x^2 - 3x + 1$
- ☐ $-x^2 - x - 7$
- ☐ $3x^2 - x - 7$
- ☐ $x^2 - 3x + 1$
- ☐ $3x^2 + x - 7$

31. What is the slope of the line defined by the equation $2x + 3y = 6$?

- ☐ $3/2$
- ☐ 6
- ☐ $2/3$
- ☐ $-2/3$
- ☐ -4

32. Which of the following best depicts the graph of $x + 2y = 4$?

☐



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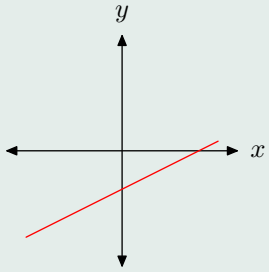

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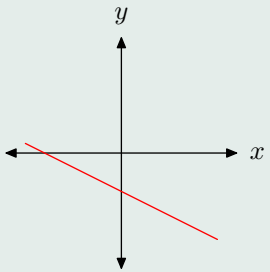

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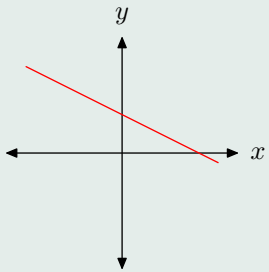


33. A rectangle has length that is 3 inches longer than twice its width. If the perimeter of the rectangle is 50 inches, what is its width?

- ☐ 22/3
- ☐ 32/3
- ☐ 33/5
- ☐ 21/5
- ☐ 11/4

34. $\dfrac{x^2-4}{x-2} =$

- ☐ $x-2$
- ☐ $x+2$
- ☐ $-2x$
- ☐ $2x$
- ☐ x^2+x+2

35. Two resistors, connected in parallel, have a combined resitance R defined by the equation

$$\frac{1}{R} = \frac{1}{r_1} + \frac{1}{r_2},$$

where r_1 and r_2 are the resistances of the individual resistors. If $r_1 = 3$ ohms and $r_2 = 2$ ohms, find the combined resistance R.

- ☐ 5 ohms
- ☐ 0.4 ohms
- ☐ 1.2 ohms
- ☐ 1.4 ohms
- ☐ 2.5 ohms

36. $3-2x < 5x-3$ is equivalent to

- ☐ $x < 6/7$
- ☐ $x < -2/7$
- ☐ $x > 5/7$
- ☐ $x > 6/7$
- ☐ $x < 4/7$

37. The area of a rectangle is $65\,\text{in}^2$. The length of the rectangle is three inches longer than twice its width. Which of the following equations can be used to determine the dimensions of the rectangle?

- ☐ $2w + 2(2w + 3) = 65$
- ☐ $2 + (2w + 3) = 65$
- ☐ $w(2w + 3) = 130$
- ☐ $w(3 + 2w) = 65$
- ☐ $\dfrac{w}{2w + 3} = 65$

38. If $y = x + 2$ and $x - 2y = 12$, then $x =$

- ☐ 8
- ☐ -16
- ☐ 24
- ☐ -12
- ☐ -4

39. Solve the equation $ax + b = cx + d$ for x.

- ☐ $\dfrac{b + d}{a + c}$
- ☐ $\dfrac{b + d}{a - c}$
- ☐ $\dfrac{d - b}{a - c}$
- ☐ $-\dfrac{bd}{ac}$
- ☐ $\dfrac{ab}{cd}$

40. One of the solutions of $4x^2 - 3x = 0$ is

- ☐ 4/3
- ☐ 3/4
- ☐ -7
- ☐ 2/3
- ☐ -2

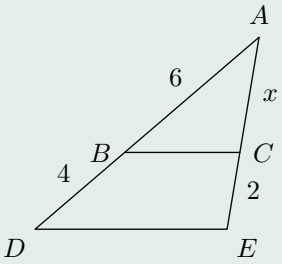
41. There are 1500 people in the city of Silvertown. If 5% of the population leaves at the end of the year, how many people remain?

- ☐ 1600
- ☐ 1475
- ☐ 1375
- ☐ 1525
- ☐ 1425

42. The sum of three consecutive odd integers is 4281. One of the integers is

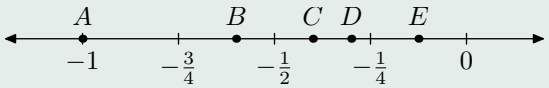
- ☐ 1429
- ☐ 1483
- ☐ 1397
- ☐ 1385
- ☐ 1401

43. Given that BC is parallel to DE, find the length of AC. *Note: Do not assume that the picture is drawn to scale.*



- ☐ 2/3
- ☐ 2
- ☐ 4
- ☐ 6
- ☐ 3

44. On the number line shown below, which point best locates $-3/5$?



- ☐ A
- ☐ B
- ☐ C
- ☐ D
- ☐ E

45. $\dfrac{a}{b} + \dfrac{c}{d} =$

- ☐ $\dfrac{a+c}{b+d}$
- ☐ $\dfrac{a+c}{bd}$
- ☐ $\dfrac{ac}{b+d}$
- ☐ $\dfrac{ab+cd}{bd}$
- ☐ $\dfrac{ad+bc}{bd}$

46. Hooke's Law tells us that the force required to stretch a spring a given distance is directly proportional to the distance stretched. If 5 pounds of force stretches a spring 3 inches, then 18 poounds of force will stretch the spring by what amount?

- ☐ 8.2 in
- ☐ 9.8 in
- ☐ 10.4 in
- ☐ 10.8 in
- ☐ 11.2 in

47. $\dfrac{x^2+2x}{x^2+5x+6} =$

- ☐ $\dfrac{x}{x+3}$
- ☐ $\dfrac{x+2}{x+3}$
- ☐ $\dfrac{x}{x+2}$
- ☐ $\dfrac{x+3}{x+2}$
- ☐ $\dfrac{2x}{x+3}$

48. Amy has a pocketful of nickels and quarters worth a total of \$3.35. She has 7 more nickels than quarters. How many quarters does she have?

- ☐ 7
- ☐ 9
- ☐ 10
- ☐ 12
- ☐ 17

49. Jamie starts a race at noon, running at a constant 6 miles per hour. Anna starts 10 minutes later, running at a constant rate of 8 miles per hour. How long does it take Anna to overtake Jamie?

- ☐ 10 min
- ☐ 12 min
- ☐ 15 min
- ☐ 20 min
- ☐ 30 min

50. $3.2 \times 10^{-3} =$

- ☐ 3200
- ☐ 320
- ☐ 32
- ☐ 0.032
- ☐ 0.0032

End Assessment | Score: | Correct

Solutions to Assessment

Solution to Question 1: Reorder and combine like terms.

$$\begin{aligned} 2a - 3c - 6a + 11c &= (2a - 6a) + (-3c + 11c) \\ &= -4a + 8c \end{aligned}$$

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Solution to Question 2: First, recall that

$$\sqrt{a}\sqrt{b} = \sqrt{ab},$$

provided that $a, b \geq 0$. Thus,

$$\sqrt{3}\sqrt{6} = \sqrt{18}.$$

Now, factor out a perfect square, as in

$$\begin{aligned} &= \sqrt{9}\sqrt{2} \\ &= 3\sqrt{2}. \end{aligned}$$

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Solution to Question 3: Recall the law of exponents $(a^m)^n = a^{mn}$. Multiply exponents.

$$(x^2)^5 = x^{(2)(5)} = x^{10}$$

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Solution to Question 4: Multiply both sides of the equation by 5.

$$5\left(x - \frac{3}{5}x\right) = 5(4)$$
$$5x - 5\left(\frac{3}{5}x\right) = 20$$
$$5x - 3x = 20$$

Simplify, then divide both sides of the equation by 2.

$$2x = 20$$
$$\frac{2x}{2} = \frac{20}{2}$$
$$x = 10$$

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Solution to Question 5: It's simplest to remember the short cut for squaring a binomial, $(a+b)^2 = a^2 + 2ab + b^2$.

$$\begin{aligned}(x+2y)^2 &= x^2 + 2(x)(2y) + (2y)^2 \\ &= x^2 + 4xy + 4y^2\end{aligned}$$

However, two applications of the distributive property produce the same result.

$$\begin{aligned}(x+2y)^2 &= (x+2y)(x+2y) \\ &= x(x+2y) + 2y(x+2y) \\ &= x^2 + 2xy + 2xy + 4y^2 \\ &= x^2 + 4xy + 4y^2\end{aligned}$$

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Solution to Question 6: Recall the defintion $a^{-n} = 1/a^n$. Thus,

$$\begin{aligned} 5^{-3} &= \frac{1}{5^3} \\ &= \frac{1}{125}. \end{aligned}$$

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Solution to Question 7: Because the diameter of the circle is 12 inches, the circle has radius $r = 6$ inches. Recall that the area of a circle is computed with the formula $A = \pi r^2$.

$$A = \pi(6)^2$$
$$A = 36\pi$$

Hence, the area of the circle is $36\pi\,\text{in}^2$.

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Solution to Question 8: The sum of the interior angles of a triangle is 180°. Thus,

$$\begin{aligned}(x+10)+(2x-20)+40 &= 180\\ 3x+30 &= 180\\ 3x &= 150\\ x &= 50\end{aligned}$$

Hence,

$$\angle A = x + 10 = 50 + 10 = 60.$$

Thus, $\angle A = 60°$.

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Solution to Question 9: Divide both numerator and denominator by a^3.

$$\frac{a^3b^6}{a^5b^2} = \frac{b^6}{a^2b^2}$$

Now divide both numerator and denominator by b^2.

$$\frac{b^6}{a^2b^2} = \frac{b^4}{a^2}$$

Hence,

$$\frac{a^3b^6}{a^5b^2} = \frac{b^4}{a^2}$$

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Solution to Question 10: If the product of two factors is zero, at least one of the factors must equal zero. Hence, if

$$(ax + b)(cx + d) = 0,$$

then

$$ax + b = 0 \qquad \text{or} \qquad cx + d = 0.$$

Solving the first of these equations,

$$\begin{aligned} ax + b &= 0 \\ ax &= -b \\ x &= -\frac{b}{a}. \end{aligned}$$

Solving the second,

$$\begin{aligned} cx + d &= 0 \\ cd &= -d \\ x &= -\frac{d}{c}. \end{aligned}$$

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Solution to Question 11: Use the distributive property to multiply.

$$\begin{aligned} 2x^3(x^2 - 3xy + y^2) &= 2x^3(x^2) + 2x^3(-3xy) + 2x^3(y^2) \\ &= 2x^5 - 6x^4y + 2x^3y^2 \end{aligned}$$

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Solution to Question 12: Compare $6x^2+x-12$ with ax^2+bx+c. List the integer pairs whose product is $ac=-72$.

$-1, 72$	$1, -72$
$-2, 36$	$2, -36$
$-3, 24$	$3, -24$
$-4, 18$	$4, -18$
$-6, 12$	$6, -12$
$-8, 9$	$8, -9$

Select the pair that adds to $b=1$; that is, -8 and 9. Now,

$$\begin{aligned} 6x^2+x-12 &= 6x^2+9x-8x-12 \\ &= 3x(2x+3)-4(2x+3) \\ &= (3x-4)(2x+3). \end{aligned}$$

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Solution to Question 13: Substitute $a = 3$ and $b = -2$ in

$$\begin{aligned} -a^3b^2 &= -(3)^3(-2)^2 \\ &= -(27)(4) \\ &= -108 \end{aligned}$$

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Solution to Question 14: Rewrite the expression with a common denominator.

$$\begin{aligned}\frac{2}{3}-\frac{4}{5} &= \frac{2}{3}\cdot\frac{5}{5}-\frac{4}{5}\cdot\frac{3}{3}\\ &= \frac{10}{15}-\frac{12}{15}\\ &= -\frac{2}{15}\end{aligned}$$

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Solution to Question 15: Add the equations

$$x + y = 4$$
$$2x - y = 6,$$

to get

$$3x = 10$$
$$x = \frac{10}{3}.$$

Substitute $x = 10/3$ in

$$x + y = 4$$
$$\frac{10}{3} + y = 4.$$

Subtract 10/3 from both sides of the equation.

$$y = 4 - \frac{10}{3}$$
$$y = \frac{12}{3} - \frac{10}{3}$$
$$y = \frac{2}{3}$$

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Solution to Question 16: To find the area, multiply the base of the triangle by the height, then divide by 2.

$$\begin{aligned} A &= \frac{1}{2}(AB)h \\ &= \frac{1}{2}(12)(10) \\ &= 60 \end{aligned}$$

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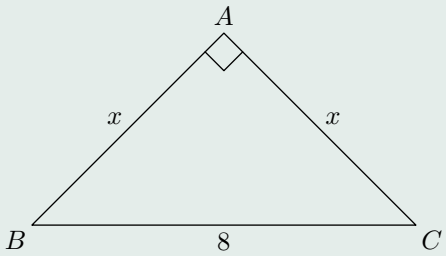
Solution to Question 17: Let $AB = AC = x$.



Using the Pythagorean Theorem,

$$\begin{aligned} x^2 + x^2 &= 8^2 \\ 2x^2 &= 64 \\ x^2 &= 32. \end{aligned}$$

Taking the square root and simplifying,

$$\begin{aligned} x &= \sqrt{32} \\ x &= \sqrt{16}\sqrt{2} \\ x &= 4\sqrt{2}. \end{aligned}$$

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Solution to Question 18: Let x represent the missing number. Then, in symbols,

$$32 = \frac{4}{5}x.$$

Note how "is" translated to and equals sign, while "of" translated to multiplication. Multiply both sides of the equation by 5.

$$5(32) = 5\left(\frac{4}{5}x\right)$$
$$160 = 4x$$

Divide both sides of the equation by 4.

$$\frac{160}{4} = \frac{4x}{4}$$
$$x = 40$$

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Solution to Question 19: Because $x \leq 3$ includes points that are "less than or equal to 3," we shade all points to the left of and including 3 on the number line.

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Solution to Question 20: We want to take a certain percent of 8 and get 12 as our result. That is, we want to multiply 8 by an unknown percent and get 12. Let x represent the unknown multiplier.

$$8x = 12$$
$$x = \frac{12}{8}$$
$$x = \frac{3}{2}$$

We must now change x to a percent. In this case, this is most easily done by creating an equivalent fraction with denominator equal to 100.

$$\frac{3}{2} = \frac{3}{2} \cdot \frac{50}{50} = \frac{150}{100}$$

Thus, x=3/2=150%.

Alternatively, we could also divide 3 by 2 to get the decimal 1.5. Moving the decimal two places to the right provides 150%.

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Solution to Question 21: Simplify each radical by extracting a perfect square.

$$\begin{aligned}\sqrt{32}-\sqrt{8} &= \sqrt{16}\sqrt{2}-\sqrt{4}\sqrt{2}\\ &= 4\sqrt{2}-2\sqrt{2}\\ &= 2\sqrt{2}\end{aligned}$$

Note how we combined like terms in the last step.

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Solution to Question 22: Recall that the *difference of two squares* factors as follows: $a^2 - b^2 = (a + b)(a - b)$. Thus,

$$\begin{aligned} 4x^2 - 9 &= (2x)^2 - (3)^2 \\ &= (2x + 3)(2x - 3). \end{aligned}$$

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Solution to Question 23: Divide both sides of the equation by Pt.

$$I = Prt$$
$$\frac{I}{Pt} = \frac{Prt}{Pt}$$

Cancel.

$$\frac{I}{Pt} = r$$

Thus, $r = I/(Pt)$.

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Solution to Question 24: Cross multiply.

$$\frac{12}{18} = \frac{3}{x}$$
$$12 \cdot x = 3 \cdot 18$$
$$12x = 54$$

Divide both sides by 12.

$$\frac{12x}{12} = \frac{54}{12}$$
$$x = \frac{54}{12}$$

Reduce.

$$x = \frac{9 \cdot 6}{2 \cdot 6}$$
$$x = \frac{9}{2}$$

Hence, $x = 9/2$.

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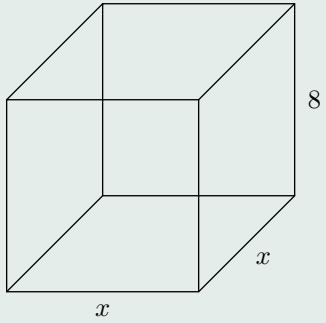
Solution to Question 25: Let x represent the length of an edge of the square base.



The volume of the box is found by multiplying the area of the base by the height of the box. Hence,

$$V = 8 \cdot x \cdot x$$
$$V = 8x^2.$$

Substitute $V = 50$.

$$50 = 8x^2$$

divide both sides of the equation by 8.

$$\frac{50}{8} = \frac{8x^2}{8}$$
$$x^2 = \frac{50}{8}$$

Reduce.

$$x^2 = \frac{25}{4}$$

Taking the square root,

$$x = \frac{5}{2}.$$

Hence, the length of an edge of the base is $x = 5/2$, or alternatively, $x = 2.5$ inches.

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Solution to Question 26: Multiply both sides of the equation by $x-1$.

$$(x-1)\left(\frac{x}{x-1}\right) = 4(x-1)$$
$$x = 4x - 4$$

Subtract $4x$ from both sides of the equation.

$$x - 4x = -4$$
$$-3x = -4$$

Divide both sides of the equation by -3.

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

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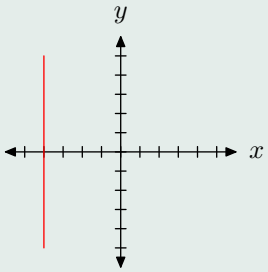
Solution to Question 27: The question is better posed if we ask for the graph of all poits (x, y) having x-coordinate $x = -4$. Thus, we have a vertical line, translated four units to the left.



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Solution to Question 28: Substitute $a = 2$ and $b = -3$.

$$\begin{aligned}\frac{2a-3b}{a+2b} &= \frac{2(2)-3(-3)}{(2)+2(-3)}\\ &= \frac{4+9}{2-6}\\ &= \frac{13}{-4}\end{aligned}$$

Thus, the solution is $-13/4$.

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Solution to Question 29: Extract a perfect square.

$$\sqrt{48} = \sqrt{16}\sqrt{3} = 4\sqrt{3}$$

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Solution to Question 30: Distribute the minus sign.

$$\begin{aligned}(x^2 - 2x - 3) - (-2x^2 + x - 4) &= x^2 - 2x - 3 + 2x^2 - x + 4 \\ &= 3x^2 - 3x + 1\end{aligned}$$

Note how we collected like terms in the last step.

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Solution to Question 31: Place the equation in the form $y = mx + b$ by solving for y. First, subtract $2x$ from both sides of the equation.

$$\begin{aligned} 2x + 3y &= 6 \\ 3y &= -2x + 6 \end{aligned}$$

Divide both sides of the equation by 3.

$$\begin{aligned} \frac{3y}{3} &= \frac{-2x + 6}{3} \\ y &= \frac{-2x}{3} + \frac{6}{3} \\ y &= -\frac{2}{3}x + 2 \end{aligned}$$

Hence, the slope of the line is $m = -2/3$.

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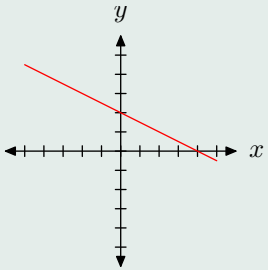
Solution to Question 32: Substitute $x = 0$ in

$$\begin{aligned} x + 2y &= 4 \\ 0 + 2y &= 4 \\ 2y &= 4 \\ y &= 2. \end{aligned}$$

Hence, the y-intercept is $y = 2$. Substitute $y = 0$ in

$$\begin{aligned} x + 2y &= 4 \\ x + 2(0) &= 4 \\ x &= 4 \end{aligned}$$

Hence, the x-intercept is $x = 4$.



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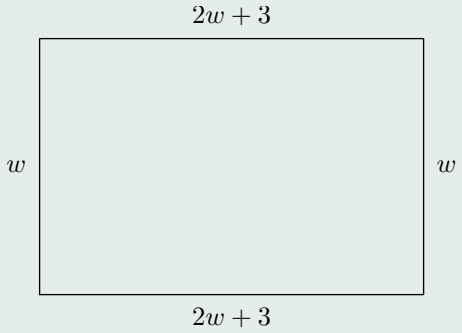
Solution to Question 33: Let w represent the width of the rectangle. The length is 3 inches more than twice the width, so $l = 2w + 3$, where we let l represent the length of the rectangle.



The perimeter is found by adding the sides of the rectangle.

$$w + (2w + 3) + w + (2w + 3) = 50$$
$$6w + 6 = 50$$

Subtract 6 from both sides of the equation, then divide by 6.

$$6w = 44$$
$$w = \frac{44}{6}$$
$$w = \frac{22}{3}$$

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Solution to Question 34: You must always factor before cancelling. thus,

$$\frac{x^2-4}{x-2} = \frac{(x+2)(x-2)}{x-2} = x+2.$$

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Solution to Question 35: Substitute $r_1 = 3\,\text{ohms}$ and $r_2 = 2\,\text{ohms}$ and add the resulting fractions.

$$\frac{1}{R} = \frac{1}{3} + \frac{1}{2}$$
$$\frac{1}{R} = \frac{2}{6} + \frac{3}{6}$$
$$\frac{1}{R} = \frac{5}{6}$$

Inverting, $R = 6/5\,\text{ohms}$, or equivalently, $R = 1.2\,\text{ohms}$.

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Solution to Question 36: Subtract $5x$ from both sides of the inequality.

$$\begin{aligned} 3 - 2x &< 5x - 3 \\ 3 - 2x - 5x &< -3 \\ 3 - 7x &< -3 \end{aligned}$$

Subtract 3 from both sides of the inequality.

$$\begin{aligned} -7x &< -3 - 3 \\ -7x &< -6 \end{aligned}$$

Divide both sides by -7. Don't forget to reverse the inequality, due to the fact that we are dividing both sides by a negative number.

$$\begin{aligned} \frac{-7x}{-7} &> \frac{-6}{-7} \\ x &> \frac{6}{7} \end{aligned}$$

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Solution to Question 37: Let w represent the width of the rectangle. Because the length is three more than twice the width, $l = 2w + 3$, where l denotes the length of the rectangle. The area of a rectangle is formed by multiplying its length by its width. Thus,

$$lw = 65.$$

But $l = 2w + 3$, so

$$(2w + 3)w = 65.$$

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Solution to Question 38: Substitute $y = x + 2$ in

$$x - 2y = 12$$
$$x - 2(x + 2) = 12.$$

Distribute and simplify.

$$x - 2x - 4 = 12$$
$$-x - 4 = 12$$

Add 4 to both sides of the equation, then multiply both sides by -1.

$$-x = 12 + 4$$
$$-x = 16$$
$$x = -16$$

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Solution to Question 39: Subtract cx from both sides of the equation.

$$ax + b = cx + d$$
$$ax - cx + b = d$$

Subtract b fro both sides of the equation.

$$ax - cx = d - b$$

Factor x from the left-hand side.

$$(a - c)x = d - b$$

Divide both sides by $a - c$.

$$x = \frac{d - b}{a - c}$$

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Solution to Question 40: Factor.

$$4x^2 - 3x = 0$$
$$x(4x - 3) = 0$$

Because the product is zero, at least one of the factors is zero. That is,

$$x = 0 \qquad \text{or} \qquad 4x - 3 = 0.$$

Solving the second factor for x,

$$\begin{aligned} 4x - 3 &= 0 \\ 4x &= 3 \\ x &= \frac{3}{4}. \end{aligned}$$

Thus, either $x = 0$ or $x = 3/4$.

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Solution to Question 41: If 5% of the population leaves, then 95% stays. Thus,

$$95\% \times 1500 = 0.95 \times 1500 = 1425.$$

Hence, 1425 people remain in Silvertown at the end of the year.

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Solution to Question 42: Let k represent an *odd* integer. Then the next two odd integers are $k+2$ and $k+4$. Their sum is 4281, so we can write

$$\begin{aligned} k + (k+2) + (k+4) &= 4281 \\ 3k + 6 &= 4281. \end{aligned}$$

Subtract 6 from both sides of the equation.

$$\begin{aligned} 3x &= 4281 - 6 \\ 3k &= 4275 \end{aligned}$$

Divide both sides by 3.

$$\begin{aligned} \frac{3k}{3} &= \frac{4275}{3} \\ k &= 1425 \end{aligned}$$

Hence, the consecutive odd integers k, $k+2$, and $k+4$ are 1425, 1427, and 1429.

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Solution to Question 43: Because BC is parallel to DE, the corresponding $\angle ABC = \angle ADE$. Similarly, $\angle ACB = \angle AED$ and triangle $\triangle ABC$ is similar to triangle $\triangle ADE$. Hence, the corresponding sides of these triangles are proportional and we can write

$$\frac{AB}{AD} = \frac{AC}{AE}$$
$$\frac{6}{10} = \frac{x}{x+2}.$$

Cross multiply.

$$6(x+2) = 10x$$
$$6x + 12 = 10x$$

Subtract $10x$ from each side of the equation.

$$6x - 10x + 12 = 0$$
$$-4x + 12 = 0$$

Subtract 12 from each side of the equation.

$$-4x = -12$$

Divide both sides by -4.

$$\frac{-4x}{-4} = \frac{-12}{-4}$$
$$x = 3$$

Hence, $AC = 3$.

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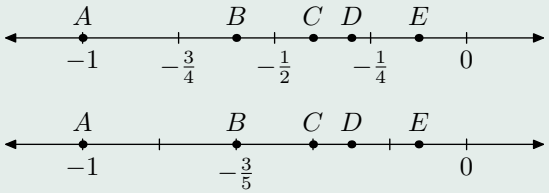
Solution to Question 44: For comparison, we divide the interval into five equal pieces.



Clearly, point B is the best choice. However, if this seems an unsatisfactory approach, note that

$$-\frac{15}{20} < -\frac{12}{20} < -\frac{10}{20}.$$

Reducing,

$$-\frac{3}{4} < -\frac{3}{5} < -\frac{1}{2}.$$

Hence, $-3/5$ falls between $-3/4$ and $-1/2$. Again, B is the best choice.

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Solution to Question 45: To add, find equivalent fractions with a common denominaotr.

$$\begin{aligned}\frac{a}{b}+\frac{c}{d} &= \frac{a}{b}\cdot\frac{d}{d}+\frac{c}{d}\cdot\frac{b}{b}\\ &= \frac{ad}{bd}+\frac{bc}{bd}\end{aligned}$$

Thus,

$$\frac{a}{b}+\frac{c}{d}=\frac{ad+bc}{bd}.$$

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Solution to Question 46: Let F represent the force and x the distance the spring stretches when the force is applied. Because F is directly proportional to x, we may write

$$F = kx.$$

Solving for k by dividing both sides of the equation by x,

$$k = \frac{F}{x}.$$

Because 5 pounds of force stretches the spring 3 inches,

$$k = \frac{5\,\text{lb}}{3\,\text{in}} = \frac{5}{3}\,\text{lb/in}.$$

Substituting $k = 5/3$,

$$F = kx$$
$$F = \frac{5}{3}x.$$

To find how far a spring is stretched when a force of 18 poinds is applied, substitute $F = 18$.

$$18 = \frac{5}{3}x$$

Multiply both sides of the equation by 3.

$$3(18) = 3\left(\frac{5}{3}x\right)$$
$$54 = 5x$$

Divide both sides by 5.

$$\frac{54}{5} = \frac{5x}{5}$$
$$x = 10.8$$

Hence, the spring stretches 10.8 inches.

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Solution to Question 47: Factor both numerator and denominator, then cancel.

$$\frac{x^2+2x}{x^2+5x+6} = \frac{x(x+2)}{(x+2)(x+3)} = \frac{x}{x+3}.$$

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Solution to Question 48: Let q represent the number of quarters, n the number of nickels. The number of nickels is 7 more than the number of quarters, so we can write

$$n = 7 + q.$$

Further, n nickels are worth $5n$ cents. Also, q quarters are worth $25q$ cents. The total worth is 335 cents, so we write

$$5n + 25q = 335.$$

Substitute $n = 7 + q$.

$$\begin{aligned} 5(y + q) + 25q &= 335 \\ 35 + 5q + 25q &= 335 \\ 35 + 30q &= 335 \end{aligned}$$

Subtract 35 from both sides of the equation, then divide by 30.

$$\begin{aligned} 30q &= 335 - 35 \\ 30q &= 300 \\ \frac{30q}{30} &= \frac{300}{30} \\ q &= 10 \end{aligned}$$

Thus, Amy has 10 quarters.

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Solution to Question 49: Let t represent the time that it takes Anna to overtake Jamie. because Jamie has been running for an additional 10 minutes (1/6 of an hour), Jamie's running time is $t + 1/6$. Because distance equals rate multiplied by time, Jamie runs

$$d_{\text{Jamie}} = 6(t + 1/6).$$

Similarly,

$$d_{\text{Anna}} = 8t.$$

Because they run the same distance,

$$\begin{aligned} 6\left(t + \frac{1}{6}\right) &= 8t \\ 6t + 1 &= 8t. \end{aligned}$$

Hence,

$$\begin{aligned} 6t - 8t &= -1 \\ -2t &= -1 \\ t &= \frac{1}{2}. \end{aligned}$$

It takes Anna a half hour (30 minutes) to overtake Jamie.

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Solution to Question 50: Multiplying by a factor of 10^{-3} will move the decimal point three places to the left. Hence,

$$3.2 \times 10^{-3} = 0.0032.$$

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