

1. Simplify each of the following expressions.

a) $\frac{x^2 - 10x + 21}{9 - x^2}$

e) $\frac{12x - 8}{-4}$

j) $\frac{2^{-2}3^{-1}}{2^03^{-2}5^{-1}}$

b) $\frac{5x - 30}{x^2 - 36} \cdot \frac{3x + 18}{5}$

f) $\sqrt{125} - 3\sqrt{80} + \sqrt{45}$

k) $\frac{2^{-2} - 3^{-1}}{2^0 - 3^{-2}}$

c) $\frac{a^3 - 4a}{a^2 + 2a} \div \frac{a^2 - 8a + 12}{a^2 - 6a}$

g) $(\sqrt{7} - 2)^2$

l) $\left(\frac{-2a^0ba^{-5}}{3a^{-2}b^2a^{-3}}\right)^{-3}$

d) $\frac{x - 2}{4 - 2x}$

h) $(\sqrt{3} - 1)^3 (\sqrt{3} + 1)^3$

m) $\frac{-2a^7b^0(2a^5b^{-3}a^{-1})^{-1}}{b^5(4a^{-3}b^2)^{-3}(-a)^{-4}}$

i) $\frac{\sqrt{40}}{6}$

2. Expand each of the following.

a) $(3x - 1)^2$ b) $(3x - 1)^3$ c) $(3x^2 - 2)^2$ d) $(x - y)(x^2 + xy + y^2)$

3. Rationalize the denominator in each of the following expressions.

a) $\frac{3}{\sqrt{5}}$ b) $\frac{1}{\sqrt{10} - 3}$ c) $\frac{2}{\sqrt{7} + 1}$ d) $\frac{3 + \sqrt{3}}{3 - \sqrt{3}}$ e) $\frac{2\sqrt{x}}{\sqrt{x} - 3}$

4. Convert each of the following decimals to a fraction of integers,

a) 1.037 b) $0.78\overline{70}$ c) $0.61\overline{8}$

5. Compute each of the following sums.

a) $8 + 16 + 24 + \dots + 2016$ b) $20 + 23 + 26 + \dots + 98$ c) $320 + 335 + 350 + \dots + 2120$

6. Factor completely each of the following.

a) $3x^2 - 7x - 6$

e) $3a^2 - 5a - 2$

i) $2x^2 - 12x + 8$

b) $13x + 2x^2 - 24$

f) $4b^2 - b - 5$

j) $10ax - 2ay - 15bx + 3by$

c) $24x - 9x^2 - 16$

g) $30x - 3x^2 - 78$

k) $2n^2p - 54m^2q - 18m^2p + 6n^2q$

d) $x^2 - 6x + 8$

h) $5a^5 - 80a$

l) $ax^2 - ay^2 + bx^2 - by^2$

7. Solve each of the following equations. Make sure to check your solution(s).

a) $2x^3 = 20x^2 + 1750x$

g) $8p^3 = 50p$

m) $|2x - 1| = |3x + 8|$

b) $\frac{3x + 17}{2} = x - 1 + \frac{x + 19}{2}$

h) $x^2 = 4x + 1$

n) $|x + 1| - 2 = 3$

c) $\frac{3}{8}x - \frac{1}{5} = -\frac{7}{40}$

i) $4x^2 + 20x + 7 = 0$

o) $|x - 1| = 2x + 11$

d) $\frac{2}{3}(x - 7) = \frac{4}{5}(x + 1)$

j) $|2x - 3| = 11$

p) $\left|\frac{2}{3}x - 1\right| + 4 = 11$

e) $8a + 2a^2 = 42$

k) $|2x - 3| = -11$

f) $8x^3 = 50x^2$

l) $5 - 2\left|\frac{1}{2}x - 9\right| = 1$

q) $|5x + 1| + 8 = 3$

r) $7x^2 + (x + 3)(2x - 1) = (3x + 1)^2$

s) $2 - (3 - x)(2x + 5) = (x - 1)(2x - 1)$

8. a) Solve the equation $3x^2 = 4x + 1$ using exact values.

b) Check your answer using exact values.

9. Solve each of the following systems of linear equations.

$$\text{a) } \begin{cases} 3x - 2y = 19 \\ 2x + y = 1 \end{cases} \quad \text{b) } \begin{cases} 3x - y = 18 \\ y = 3(x + 6) \end{cases} \quad \text{c) } \begin{cases} (x + 1)^2 + (y - 2)^2 = x^2 + (3 - y)^2 \\ \frac{1}{2}x - \frac{1}{3}y = -4 \end{cases}$$

10. Simplify each of the following compound inequalities.

$$\begin{array}{lll} \text{a) } 3 < a \text{ and } a < -1 & \text{c) } -5 < w \text{ and } w \leq 5 & \text{e) } m > -4 \text{ and } m \geq 7 \\ \text{b) } 3 < a \text{ or } a < -1 & \text{d) } -5 < w \text{ or } w \leq 5 & \text{f) } m > -4 \text{ or } m \geq 7 \end{array}$$

11. Solve each of the following compound inequalities.

$$\begin{array}{ll} \text{a) } 3x - 1 \leq 7 - x \text{ and } \frac{1}{3}x + 1 < 5 & \text{c) } 2(x - 1) - 3(5 - x) > x + 11 \text{ and } (x - 2)^2 - (x - 1)^2 \geq 13 \\ \text{b) } 3x - 1 \leq 7 - x \text{ or } \frac{1}{3}x + 1 < 5 & \text{d) } 2(x - 1) - 3(5 - x) > x + 11 \text{ or } (x - 2)^2 - (x - 1)^2 \geq 13 \\ \text{e) } \frac{1}{2}x - \frac{1}{3} > \frac{5}{12} \text{ and } \frac{3 - x}{5} \geq -2 & \\ \text{f) } \frac{1}{2}x - \frac{1}{3} > \frac{5}{12} \text{ or } \frac{3 - x}{5} \geq -2 & \end{array}$$

12. Find the smallest value of the given expressions.

$$\text{a) } x^2 - 20x + 38 \quad \text{b) } x^4 + 2x^2 - 2 \quad \text{c) } x^4 - 2x^2 - 2$$

13. a) Graph the line $3x - 4y = -5$. Make sure to find two lattice points.

b) Graph the straight lines $3x + 5y = 5$ and $y = -x - 1$ in the same coordinate system. Use your graph to find the coordinates of the point where the lines intersect.

c) Graph the parabola $y = x^2 - 6x + 5$. Clearly state the coordinates of five points on the parabola, including vertex and intercepts.

14. Find the slope of each of the following.

$$\begin{array}{lll} \text{a) } \text{a vertical line} & \text{c) } \text{the line } x + y = -8 & \text{e) } \text{the line } y = 1 \\ \text{b) } \text{the line } 2x - 3y = 11 & \text{d) } \text{the line } x = -3 & \text{f) } \text{the line connecting } A(-6, 6) \text{ and } B(12, -3) \end{array}$$

15. a) One number is four less than three times another number. Find these numbers if their sum is 64.

b) One number is four less than three times another number. Find these numbers if their product is 160.

16. Find the distance between the points $A(-3, -5)$ and $B(3, 3)$.

17. a) Find the exact value of the area of a triangle with sides 8 m, 6 m, and 6 m long.

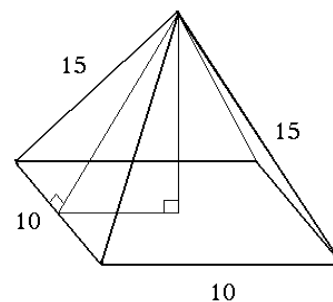
b) Find the exact value of the area of a regular triangle with sides 5 meters long.

18. An arch is in the shape of a semicircle. At a point along the base 1 foot from an end of the arch, the height of the arch is 5 feet. Find the maximum height of the arch. Present exact value of the answer.

19. The picture shows a straight pyramid with a square base. The sides of the base are 10 in long. The other sides are 15 in long.

a) Find the exact value of the height of a triangular face. This is called the slant height.

b) Use part a) to find the height of the pyramid.



20. Find the sides in a rectangle if we know that one side is 12 cm and the diagonal of the rectangle is 2 cm longer than the other side.
21. Solve the following word problems.
- One side of a rectangle is 4 ft shorter than three times the other side. Find the sides if the perimeter is 64 ft.
 - One side of a rectangle is 4 ft shorter than three times the other side. Find the sides if the area is 84 ft^2 .
 - One side of a rectangle is 4 in shorter than 3 times the other side. Find the sides of the rectangle if its area is 319 in^2 .
 - A bank teller has 23 more five-dollar bills than ten-dollar bills. The total value of the money is \$610. How much of each denomination of bill does he have?
 - We have some coins in a jar, all dimes and quarters. How many of each type of coins do we have if all together, we have 84 coins worth \$16.20?
 - We invested \$10 000 into two bank accounts. One account earns 14% per year, the other account earns 8% per year. How much did we invest into each account if the combined interest from the two accounts is \$1238 after the first year?
 - The digits in a two-digit number add up to 13. If we interchange the digits in the number, we obtain a new number that is 45 greater than the original number. Find the original number.
 - The ten's digit in a two-digit number is 6 less than the one's digit. If we interchange the digits in the number, we obtain a new number that, when added to the original number, results in the sum 110. Find this number.
 - The hypotenuse of right triangle is 50 meters long. The difference between the other two sides is 34 meters. Find the missing sides. Use exact values.

Answers

- $\frac{-x+7}{x+3}$
 - 3
 - a
 - $-\frac{1}{2}$
 - $-3x+2$
 - $-4\sqrt{5}$
 - $11-4\sqrt{7}$
 - 8
 - $\frac{\sqrt{10}}{3}$
 - $\frac{15}{4}$
 - $-\frac{3}{32}$
 - $-\frac{27b^3}{8}$
 - $-\frac{64b^4}{a^2}$
- $9x^2-6x+1$
 - $27x^3-27x^2+9x-1$
 - $9x^4-12x^2+4$
 - x^3-y^3
- $\frac{3}{\sqrt{5}}$
 - $\sqrt{10}+3$
 - $\frac{\sqrt{7}-1}{3}$
 - $2+\sqrt{3}$
 - $\frac{2x+6\sqrt{x}}{x-9}$
- $\frac{1037}{1000}$
 - $\frac{7792}{9900}$
 - $\frac{557}{900}$
- 255 024
 - 1593
 - 147 620
- $3\left(x+\frac{2}{3}\right)(x-3)$
 - $2(x+8)\left(x-\frac{3}{2}\right)=(x+8)(2x-3)$
 - $-9\left(x-\frac{4}{3}\right)^2$
 - $(x-2)(x-4)$
 - $(a-2)(3a+1)$
 - $(4b-5)(b+1)$
 - $-3(x^2-10x+26)$
 - $5a(a^2+4)(a+2)(a-2)$
 - $2(x-3+\sqrt{5})(x-3-\sqrt{5})$
 - $(2a-3b)(5x-y)$
 - $2(n-3m)(n+3m)(p+3q)$
 - $(x-y)(x+y)(a+b)$

7. a) $-35, 0, 25$ b) identity, all real numbers are solution c) $\frac{1}{15}$ d) -41 e) $-7, 3$ f) $\frac{25}{4}, 0$
 g) $-\frac{5}{2}, 0, \frac{5}{2}$ h) $2 + \sqrt{5}, 2 - \sqrt{5}$ i) $\frac{-5 + \sqrt{18}}{2}, \frac{-5 - \sqrt{18}}{2}$ j) $7, -4$ k) no solution l) $14, 22$
 m) $-9, -\frac{7}{5}$ n) $4, -6$ o) $-\frac{10}{3}$ p) $-9, 12$ q) no solution r) -4 s) 7

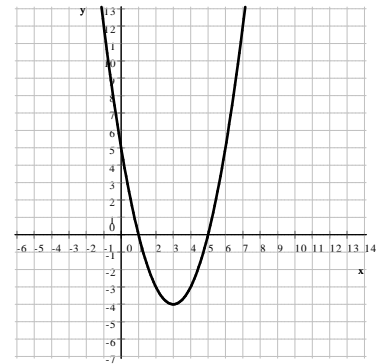
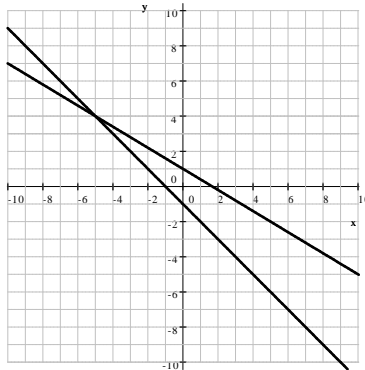
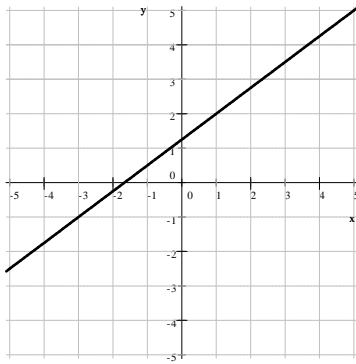
8. a) $\frac{2 - \sqrt{7}}{3}$ and $\frac{2 + \sqrt{7}}{3}$

b) Checking $x = \frac{2 - \sqrt{7}}{3}$

$$\text{LHS} = 3x^2 = 3 \left(\frac{2 - \sqrt{7}}{3} \right)^2 = 3 \frac{(2 - \sqrt{7})^2}{3^2} = 3 \cdot \frac{4 + 7 - 4\sqrt{7}}{9} = \frac{11 - 4\sqrt{7}}{3}$$

$$\text{RHS} = 4x + 1 = 4 \left(\frac{2 - \sqrt{7}}{3} \right) + 1 = \frac{4}{1} \cdot \frac{2 - \sqrt{7}}{3} + 1 = \frac{8 - 4\sqrt{7}}{3} + \frac{3}{3} = \frac{11 - 4\sqrt{7}}{3}$$

9. a) $x = 3, y = -5$ b) no solution c) $x = -4, y = 6$
 10. a) no solution b) can not be simplified c) $-5 < w \leq 5$ d) \mathbb{R} e) $m \geq 7$ f) $m > -4$
 11. a) $(-\infty, 2]$ b) $(-\infty, 12)$ c) no solution d) $(-\infty, -5] \cup (7, \infty)$ e) $\left(\frac{3}{2}, 13 \right]$ f) \mathbb{R} (all real numbers)
 12. a) -62 b) -2 c) -3
 13. a) b) $(-5, 4)$ c)



y -intercept: $(0, 5)$ vertex: $(3, -4)$ x -intercepts: $(1, 0)$ and $(5, 0)$.
 more points: $(2, -3)$, $(4, -3)$, and $(6, 5)$

14. a) undefined b) $\frac{2}{3}$ c) -1 d) undefined e) 0 f) $-\frac{1}{2}$
 15. a) 17 and 47 b) 8 with 20 and $-\frac{20}{3}$ with -24 16. 10 units 17. a) $8\sqrt{5} \text{ m}^2$ b) $\frac{25\sqrt{3}}{4} \text{ m}^2$
 18. 13 ft 19. a) $\sqrt{200} \text{ in} = 10\sqrt{2} \text{ in}$ b) $\sqrt{175} \text{ in} = 5\sqrt{7} \text{ in}$ 20. 12 cm by 35 cm
 21. a) 9 ft and 23 ft b) 6 ft and 14 ft c) 11 in by 29 in d) 33 ten-dollar bills and 56 five-dollar bills
 e) 52 quarters and 32 dimes f) $\$7300$ at 14% and $\$2700$ at 8% g) 49 h) 28 i) $14 \text{ m}, 48 \text{ m}, 50 \text{ m}$