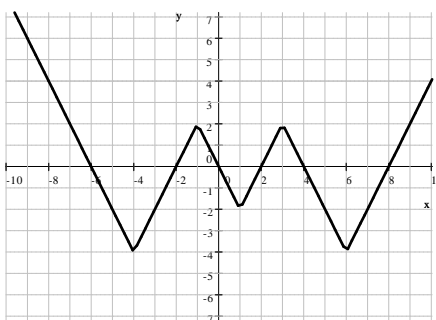


- Re-write $0.3\overline{072}$ as a fraction of integers.
- Simplify each of the following.
 - $(4\sqrt{3} - 2)^2$
 - $\sqrt{20} - 3\sqrt{180} + \sqrt{500}$
 - Rationalize the denominator in $\frac{6}{5 - \sqrt{7}}$
 - Find the exact value of $x^2 - 5x + 8$ if $x = 1 - 2\sqrt{3}$
- Simplify each of the following.
 - $\frac{2a^{-5}(2a^{-2})^{-3}(-4a^0)}{(2a^{-2})^{-3}(-4a)^2}$
 - $\frac{2x^{-2}(-2xy^{-1})^3}{4xy^{-5}}$
 - $\frac{3^x \cdot 6^{x+1}}{2^x \cdot 9^{x-1}}$
 - $\frac{3^{2x-3} \cdot 2^{3x+1}}{6^{2x-1}}$
 - $\frac{1 - 3^{-1}}{2 + 3^{-2}} = \frac{6}{19}$
 - $\left(\frac{2^{-2} - 3^{-2}}{1 - 2^{-1}(3^{-1})}\right)^0$
 - $\frac{3 + x^{-1}}{9 - x^{-2}}$
 - $\frac{2^{2018} + 5 \cdot 2^{2019}}{2^{2020}}$
- Let x denote the number 2^{143} . Simplify the expression $2^{143} + 3 \cdot 2^{144} + 2^{145}$ and write it in terms of x .
- Solve each of the following equations. Make sure to check your solution.
 - $x^3 = 24x^2 + 217x$
 - $\frac{3-x}{4} - \frac{10-3x}{5} = x+2$
 - $(3x-2)(9-x) = 5x - 2(x-3)^2$
 - $3(x-5) - 5(x-1) = -2x+1$
 - $18x^3 = 2x$
- Solve $3x^2 + 5x = 1$ by completing the square.
 - Check your solution(s), using exact values.
- Three sides of a triangle are 10, 15, and x units long.
 - What values are possible for x ?
 - What values are possible for x if it is the length of the shortest side?
 - What values are possible for x if it is the length of the longest side?
- Solve each of the following system of linear equations.
 - $\begin{cases} 3x - 5y = -12 \\ y - x = 4 \end{cases}$
 - $\begin{cases} 2x + 5y = -11 \\ 3x - y = -25 \end{cases}$
 - $\begin{cases} 2x + 3y = -1 \\ y = -\frac{2}{3}x + 2 \end{cases}$
- Completely factor each of the following.
 - $4 - 6x^2 - 2x$
 - $2x^2 - 12x + 20$
 - $a^3 - x^2 + a^3x^2 - 1$
 - $16y^4 - 1$
- Factor each of the following by completing the square.
 - $3x^2 - 4x - 319$
 - $3x^2 - 3x + 4$
 - $20x - 2x^2 - 46$
 - $-4x^2 + 3x + 7$
- Find all real numbers x with the following property: x is exactly 6 less than its own reciprocal.
- Graph each of the following equations.
 - $y = -\frac{2}{3}x + 1$
 - $y = x^2 + 4x - 56$
 - $2x - 3y + xy = 6$
- We are organizing a mini-lottery. We will randomly draw three numbers out of $\{1, 2, 3, 4, 5, 6, 7\}$. List all possible outcomes.

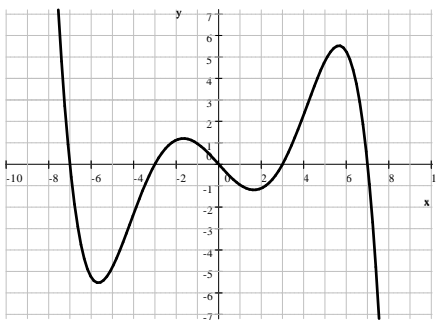
14. a) Find the set of all values of x for which $P(x, y)$ is on the graph shown and

- i) $y < 0$
- ii) $y \leq -6$
- iii) $y \geq 2$



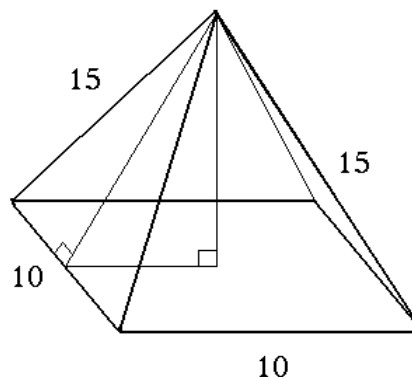
- b) Find the set of all values of x for which $P(x, y)$ is on the graph shown and

- a) $y \geq 0$
- b) $y < 0$



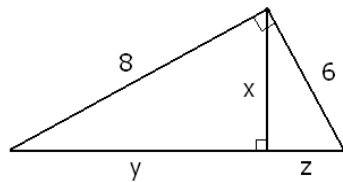
15. There is an animal farm where chickens and cows live. All together, there are 53 heads and 174 legs. How many chickens, how many cows?
16. We invested \$10000 into two bank accounts. One account earns 14% per year, the other account earns 8% per year. How much did we invest into each account if the combined interest from the two accounts is \$1238 after the first year?
17. In a hotel, the first night costs 45 dollars, and all additional nights cost 35 dollars. How long did Mr. Williams stay in the hotel if his bill was 325 dollars?
18. What is the smallest value of the expression $x^2 - 20x + 85$?
19. 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.
20. Find the distance between the points $A(-3, -5)$ and $B(3, 3)$.
21. Compute the exact value of the area of the triangle with sides 6, 6, and 8 units long.
22. a) Find the exact value of the area of a triangle with sides 8 m, 7 m, and 7 m long.
b) Find the exact value of the area of a regular triangle with sides 5 meters long.
23. 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.

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

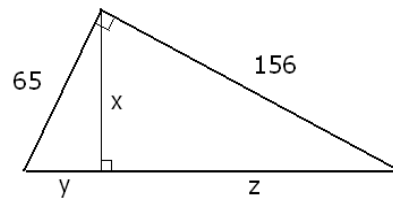


- a) Find the height of a triangular face.
- b) Use part a) to find the height of the pyramid.

25. a) List all three-digit numbers that can be formed using only the digits 2, 5, 7 and 9.
 b) List all three-digit numbers that can be formed using only the digits 2, 5, 7 and 9 and repetition of digits is not allowed. (For example, 225 is not allowed.)
26. There are 60 men and 100 women in a large conference room.
 a) How many handshakes would take place if all person shook hands with all other people in the room?
 b) How many handshakes would take place if all men shook hands with all other men in the room, and all women shook hands with all women in the room, but no man shook hands with any woman?
 c) How many handshakes would take place if all men shook hands with all woman, but no two men or two women man shook hands?
27. A 5.5 feet tall person is standing 20 feet away from a street light that is 18 feet tall. How long is her shadow?
28. Find the exact value of x , y , and z based on the pictures given.

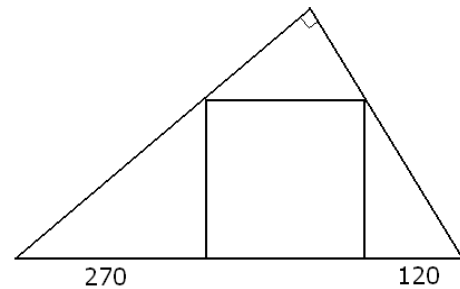


(a)



(b)

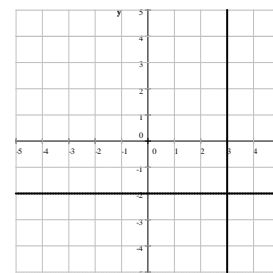
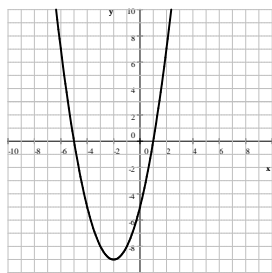
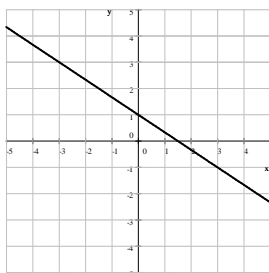
29. The picture shows a square within a right triangle. Find the length of the sides in the square.



Answers

1. $\frac{3042}{9900}$ 2. a) $52 - 16\sqrt{3}$ b) $-6\sqrt{5}$ c) $\frac{\sqrt{7} + 5}{3}$ d) $6\sqrt{3} + 16$
3. a) $-\frac{1}{2a^7}$ b) $-4y^2$ c) 54 d) $\frac{4 \cdot 2^x}{9}$ e) $\frac{6}{19}$ f) 1 g) $\frac{x}{3x-1}$ 4. $11x$
5. a) $-7, 0, 31$ b) -5 c) $0, 12$ d) no solution e) $-\frac{1}{3}, 0, \frac{1}{3}$
6. a) $\frac{-5 \pm \sqrt{37}}{6}$ b) if $x = \frac{-5 + \sqrt{37}}{6}$, then
- $$\begin{aligned} \text{LHS} &= 3x^2 + 5x = 3 \left(\frac{-5 + \sqrt{37}}{6} \right)^2 + 5 \left(\frac{-5 + \sqrt{37}}{6} \right) = 3 \cdot \frac{25 + 37 - 10\sqrt{37}}{36} + 5 \cdot \frac{-5 + \sqrt{37}}{6} \\ &= \frac{62 - 10\sqrt{37}}{12} + \frac{-25 + 5\sqrt{37}}{6} = \frac{31 - 5\sqrt{37}}{6} + \frac{-25 + 5\sqrt{37}}{6} = \frac{31 - 5\sqrt{37} + 25 + 5\sqrt{37}}{6} = \frac{6}{6} = 1 = \text{RHS} \end{aligned}$$

7. a) $5 < x < 25$ b) $5 < x < 10$ c) $15 < x < 25$ 8. a) $x = -4, y = 0$ b) $x = -8, y = 1$ c) no solution
 9. a) $-2(3x - 2)(x + 1)$ b) $2(x^2 - 6x + 10)$ c) $(x^2 + 1)(a - 1)(a^2 + a + 1)$ d) $(4y^2 + 1)(2y - 1)(2y + 1)$
 10. a) $3\left(x + \frac{29}{3}\right)(x - 11)$ b) can not be factored c) $-2(x - 5 + \sqrt{2})(x - 5 - \sqrt{2})$ d) $-4(x + 1)\left(x - \frac{7}{4}\right)$
 11. $-3 + \sqrt{10}$ and $-3 - \sqrt{10}$ 12. a) $y = -\frac{2}{3}x + 1$ b) $y = x^2 + 4x - 5$ c*) $2x - 3y + xy = 6$



13. $15 + 10 + 6 + 3 + 1 = 35$

outcomes with their smallest number being 1 $\Rightarrow 15$

- {1, 2, 3}
- {1, 2, 4} {1, 3, 4}
- {1, 2, 5} {1, 3, 5} {1, 4, 5}
- {1, 2, 6} {1, 3, 6} {1, 5, 6} {1, 6, 7}
- {1, 2, 7} {1, 3, 7} {1, 5, 7} {1, 6, 8} {1, 7, 8}

outcomes with their smallest number being 2 $\Rightarrow 10$

- {2, 3, 4}
- {2, 3, 5} {2, 4, 5}
- {2, 3, 6} {2, 4, 6} {2, 5, 6}
- {2, 3, 7} {2, 4, 7} {2, 5, 7} {2, 6, 8}

outcomes with their smallest number being 3 $\Rightarrow 6$

- {3, 4, 5}
- {3, 4, 6} {3, 5, 6}
- {3, 4, 7} {3, 5, 7} {3, 6, 7}

outcomes with their smallest number being 4 $\Rightarrow 3$

- {4, 5, 6}
- {4, 5, 7} {4, 6, 7}

outcomes with their smallest number being 5 $\Rightarrow 1$

- {5, 6, 7}

14. a) i) $(-6, -2) \cup (0, 2) \cup (4, 8)$ ii) there is no such x iii) $(-\infty, -7] \cup \{-1, 3\} \cup [9, \infty)$
 b) i) $(-\infty, -7] \cup [-3, 0] \cup [3, 7]$ ii) $(-7, -3) \cup (0, 3) \cup (7, \infty)$

15. 19 chickens and 34 cows 16. \$7300 at 14% and \$2700 at 8% 17. 8 nights 18. -15 (when $x = 10$)

19. a) 17 and 47 b) 8 with 20 and $-\frac{20}{3}$ with -24 20. 10 units 21. $8\sqrt{5}$ 22. a) $4\sqrt{33} \text{ m}^2$ b) $\frac{25}{4}\sqrt{3} \text{ m}^2$

23. 13 ft 24. a) $10\sqrt{2} \text{ in} \approx 14.142136 \text{ in}$ b) $5\sqrt{7} \text{ in} \approx 13.228757 \text{ in}$

25. a) There are 64 numbers as.

222	252	272	292	522	552	572	592	722	752	772	792	922	952	972	992
225	255	275	295	525	555	575	595	725	755	775	795	925	955	975	995
227	257	277	297	527	557	577	597	727	757	777	797	927	957	977	997
229	259	279	299	529	559	579	599	729	759	779	799	929	959	979	999

b) There are 24 such numbers.

257	275	295	527	572	592	725	752	792	925	952	972
259	279	297	529	579	597	729	759	795	927	957	975

26. a) 12720 b) 6720 c) 6000 27. 8.8 feet
 28. a) $x = \frac{24}{5}$ $y = \frac{32}{5}$ $z = \frac{18}{5}$ b) $x = 60$ $y = 25$ $z = 144$ 29. 180

References

1. Fractions and Decimals
2. Radical Expressions
3. Rules of Exponents, Complex Fractions, Integer Exponents
4. Exponents 1
5. Linear Equations, Factoring 1
6. Completing the Square Part 4, Radical Expressions
7. Triangle Inequalities
8. Systems of Linear Equations (substitution, elimination)
9. Factoring A, Factoring 1
10. Completing the Square 1, 2, 3, 4
11. Completing the Square 4
12. Graphing Lines, Graphing Parabolas 1
13. Combinatorics 1
14. Graphical Solutions
15. Systems of Linear Equations (substitution, elimination)
16. Systems of Linear Equations (substitution, elimination)
17. Linear Word Problems
18. Smallest Value of a Quadratic Expression
19. a) Linear Word Problems, b) Factoring 1
20. Pythagorean Theorem
21. Pythagorean Theorem
22. Pythagorean Theorem
23. Pythagorean Theorem
24. Pythagorean Theorem
25. Combinatorics 1
26. Combinatorics 1
27. Similar Triangles
28. Similar Triangles
29. Hint: try similar triangles!

Last revised: September 13, 2018