

1. Simplify each of the following.

a) $\mathbb{N} \cup \mathbb{Z}$ b) $\mathbb{N} \cap \mathbb{Z}$ c) $(1, 7) \cup (3, \infty)$ d) $(1, 7) \cap (3, \infty)$

2. Simplify each of the following.

a) $\frac{x^2 - 2x - 48}{x^2 - 36}$ b) $\frac{6x - 10}{5 - 3x}$ c) $\frac{x^2 - 9}{x^2 - 2x - 3} \div \frac{x^2 + 3x}{x^2 + 2x + 1}$ d) $\frac{a^2 - 4}{a^2 - 2a} \cdot \frac{a^2 + 3a}{9 - a^2}$

3. Simplify each of the following compound inequalities.

a) $3 < p$ and $p > -1$ c) $x > 0$ and $x \leq 5$ e) $m > 4$ and $m \leq -7$
 b) $3 < p$ or $p > -1$ d) $x > 0$ or $x \leq 5$ f) $m > 4$ or $m \leq -7$

4. Simplify each of the following.

a) $(\sqrt{5} - 2)^3 (\sqrt{5} + 2)^3$ c) $\sqrt{50} - 3\sqrt{8} + \sqrt{18}$ e) $\frac{1}{\sqrt{5}} \left(\left(\frac{\sqrt{5} + 1}{2} \right)^2 - \left(\frac{\sqrt{5} - 1}{2} \right)^2 \right)$
 b) $\frac{\sqrt{5} - 1}{2} + \frac{2}{\sqrt{5} + 1}$ d) $\frac{\sqrt{40} - 12}{6}$

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

a) $\frac{12}{\sqrt{7} - 1}$ b) $\frac{12}{\sqrt{5} - 3}$ c) $\frac{1}{3 + \sqrt{10}}$ d) $\frac{\sqrt{5} - \sqrt{2}}{\sqrt{5} + \sqrt{2}}$

6. Find the exact value of each of the following.

a) $-x^2 + 3x - 5$ if $x = 2\sqrt{3} - 1$ b) $x^4 - 2x^2 + 3$ if $x = -\sqrt{5} + 1$ c) $x^2 - 8x + 1$ if $x = 4 - \sqrt{15}$

7. Re-write each of the following decimals as a fraction of two integers. You do NOT have to bring the fraction to lowest terms.

a) 1.043 b) $6.\bar{3} = 6.3333\dots$ c) $0.41\bar{2} = 0.412222\dots$ d) $0.7\bar{35} = 0.735353535\dots$ e) $0.\bar{735} = 0.735735735\dots$

8. Compute each of the following sums.

a) $5 + 10 + 15 + 20 + \dots + 500$ b) $27 + 36 + 45 + \dots + 99$ c) $99 + 103 + 107 + \dots + 2015$

9. Factor each of the following over the real numbers by completing the square.

a) $x^2 - 3x - 10$ c) $9x^2 - 3x - 2$ e) $x^2 - \frac{4}{3}x + \frac{4}{9}$
 b) $6x^2 - 7x - 3$ d) $4x^2 - 20x + 34$

10. Completely factor each of the following.

a) $x^2 - 25$ over \mathbb{Z} b) $x^2 - 25$ over \mathbb{R} c) $x^2 - 7$ over \mathbb{Z} d) $x^2 - 7$ over \mathbb{R}

11. Solve each of the following equations.

a) $(2x - 1)^2 - (x + 3)^2 = 2x^2 - 8$ c) $3(x - 1) + x^2 = x + 1$ f) $4x^8 = 12x^8$
 b) $\frac{3x - 1}{2} - \frac{x - 1}{3} = 2x + 4$ d) $4x^8 = 12x^6$ g) $(3x - 1)(x - 5)^2 = 0$
 e) $4x^8 = 12x^7$ h) $x^4 = 16$

12. Solve each of the following inequalities.

a) $\frac{3x - 1}{2} - \frac{x - 4}{3} \geq x + 2$ b) $\frac{1}{2}(x - 3) - \frac{2}{3}(2x + 1) > \frac{1}{6}(x - 1)$ c) $(x - 5)^2 \geq (x + 1)^2$

13. Solve each of the following compound inequalities.

a) $(x - 3)^2 - (x + 1)^2 < 2x + 28$ and $\frac{1}{2}x - \frac{1}{3} > \frac{1}{3}x - \frac{1}{6}$

b) $(x - 3)^2 - (x + 1)^2 < 2x + 28$ or $\frac{1}{2}x - \frac{1}{3} > \frac{1}{3}x - \frac{1}{6}$

c) $3(x - 2) - 5(x - 1) \geq 2(2x - 7) + 1$ and $2(x - 3(x - 4(x - 5))) > 18x - 100$

d) $3(x - 2) - 5(x - 1) \geq 2(2x - 7) + 1$ or $2(x - 3(x - 4(x - 5))) > 18x - 100$

14. What is the smallest possible value of the expression given?

a) $x^2 + 20x + 70$ b) $x^2 - 16x + 100$ c) $x^2 + 8x - 20$

15. a) Graph the lines $3x - 4y = -5$ and $x + 2y = -5$ in the same coordinate system. Use your graph to find the coordinates of the point where the graphs intersect each other.

b) Graph the parabola $y = x^2 - 6x$. State the coordinates of at least five points, including vertex and intercepts.

16. Solve each of the following word problems.

a) 18% of a number is 63. Find this number.

b) One number is four less than twice another. Find these numbers if their product is 70.

c) When we cube a number, we get sixteen times the original number. Find this number.

d) The sum of three consecutive integers is -75 . Find these numbers.

e) The square of a number is 8 greater than twice the opposite of the number. Find this number.

f) One side of a rectangle is 24 cm shorter than four times the other side. Find the length of the sides if the perimeter of the rectangle is 62 cm.

g) One side of a rectangle is 24 cm shorter than four times the other side. Find the length of the sides if the area of the rectangle is 160 cm.

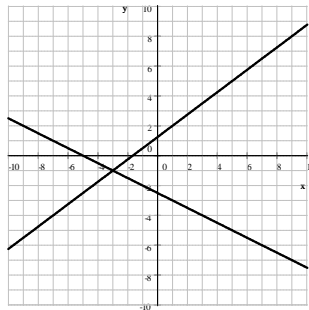
h) Find the sides of a square if we know the following. If we increased each side of the square by 1 cm, the area of the square would increase by 6 cm^2 .

i) We throw an object upward from the top of a 960 feet tall building. The vertical position h of the object, (measured in feet) t seconds after we threw it is $h = -16t^2 + 64t + 960$. How long does it take for the object to hit the ground?

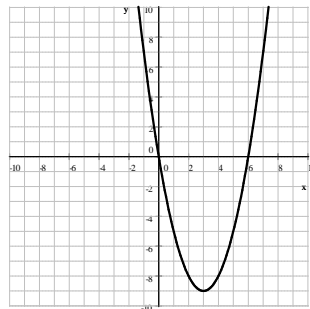
j) An auditorium has long rows of seats. The first row contains 100 seats. As you move to the rear of the auditorium, each row has 4 more seats than the previous row. If the last row has 216 seats, how many people can be seated in the auditorium?

Answers

1. a) \mathbb{Z} b) \mathbb{N} c) $(1, \infty)$ d) $(3, 7)$
2. a) $\frac{x-8}{x-6}$ b) -2 c) $\frac{x+1}{x}$ d) $\frac{-a-2}{a-3}$
3. a) $p > 3$ b) $p > -1$ c) $0 < x \leq 5$ d) \mathbb{R}
 e) \emptyset f) $m > 4$ or $m \leq -7$ (can not be simplified)
4. a) 1 b) $\sqrt{5}-1$ c) $2\sqrt{2}$ d) $\frac{\sqrt{10}-6}{3}$ e) 1
5. a) $2\sqrt{7}+2$ b) $-3\sqrt{5}-9$ c) $\sqrt{10}-3$
 d) $\frac{7-2\sqrt{10}}{3}$
6. a) $-21+10\sqrt{3}$ b) $47-20\sqrt{5}$ c) 0
7. a) $\frac{1043}{1000}$ b) $\frac{57}{9}$ c) $\frac{371}{900}$ d) $\frac{728}{990}$ e) $\frac{735}{999}$
8. a) 25 250 b) 567 c) 507 360
9. a) $(x-5)(x+2)$ b) $6\left(x-\frac{3}{2}\right)\left(x+\frac{1}{3}\right)$
 c) $9\left(x-\frac{2}{3}\right)\left(x+\frac{1}{3}\right)$ d) $2(2x^2-10x+17)$
 e) $\left(x-\frac{2}{3}\right)^2$
10. a) $(x+5)(x-5)$ b) $(x+5)(x-5)$ c) x^2-7
 d) $(x+\sqrt{7})(x-\sqrt{7})$
11. a) 0, 10 b) -5 c) $-1 \pm \sqrt{5}$ d) $0, -\sqrt{3}, \sqrt{3}$
 e) 0, 3 f) 0 g) $5, \frac{1}{3}$ h) $-2, 2$
12. a) $[7, \infty)$ b) $(-\infty, -2)$ c) $(-\infty, 2]$
13. a) $(1, \infty)$ b) $(-2, \infty)$ c) \emptyset d) $(-\infty, 2] \cup (10, \infty)$
14. a) -30 b) 36 c) -36
15. a) $(-3, -1)$



- b) vertex: $(3, -9)$
 y -intercept: $(0, 0)$
 x -intercepts: $(0, 0)$ and $(6, 0)$
 additional points: $(2, -8)$, $(4, -8)$



16. a) 350 b) -5 with -14 and 7 with 10
 c) $-4, 0, 4$ d) $-26, -25, -24$ e) -4 or 2
 f) 11 cm by 20 cm g) 10 cm by 16 cm
 h) 2.5 cm i) 10 seconds j) 6120

Last revised: November 1, 2017