

1. Solve each of the following equations by completing the square.

a) $16x + x^2 = 36$ b) $x^2 + 4x = -13$ c) $x + 6x^2 = 1$ d) $x^2 + x = 1$

2. Graph the lines $y = -\frac{2}{3}x + 1$ and $x + y = 3$ in the same coordinate system. Use your graph to find the coordinates of the point where the lines intersect each other.

3. Graph the parabola $y = x^2 - 10x + 16$. State the coordinates of at least five points, including vertex and intercepts.

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

a) $\begin{cases} 3x - 8y = 15 \\ x + 3y = 5 \end{cases}$ b) $\begin{cases} \frac{1}{2}x + \frac{1}{3}y = 3 \\ \frac{1}{3}x - \frac{1}{2}y = -11 \end{cases}$ c) $\begin{cases} x + y = 17 \\ x - y = 5 \end{cases}$ d*) $\begin{cases} x^2 - y^2 = 15 \\ x - y = 5 \end{cases}$

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

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

6. Completely factor each of the following over the integers.

a) $(3a+1)^2 - 49$ b) $200x + 2x^3$ c) $5x^6 - 80x^2$ d) $x^{10} - 49$

7. Simplify each of the following.

a) $\frac{4x^2 - 16}{4x^2 - 8x}$ d) $\frac{(-2a^3b^{-1})^{-2}(bab^{-1}a^0)^3}{(-a^3)^4(-ba^2)^{-3}}$ g) $(\sqrt{7}-1)^2(\sqrt{7}+1)^2$
 b) $\frac{3a^3 - 3a^2}{5a^3 - 5a} \cdot \frac{5a^2 + 5a}{6a^2}$ e) $\frac{30 - \sqrt{24}}{6}$ h) $(\sqrt{5}-1)^3(\sqrt{5}+1)^3$
 c) $\frac{3a^2 - 1}{1 - 3a^2}$ f) $\sqrt{12x^5} - \sqrt{75x^5} + \sqrt{300x^5}$ i) $(\sqrt{3}-2)^4(\sqrt{3}+2)^4$
 j) $\frac{1}{(3\sqrt{2}-4)^2}$

8. Solve each of the following.

a) $(x+2)^2 - (x-2)^2 = x(x-8)$ g) $\frac{1}{3}(x+2) + x - \frac{3}{4}(3x-1) = -\frac{x+3}{2}$
 b) $(x-3)^2 + (x+3)^2 = 2(x-1)^2$ h) $3(x-2) - 5(6x-1) \geq 3x-1$
 c) $(2x-1)^2 - 5(x^2-2x) = 6x$ i) $\frac{3x-8}{4} < \frac{5x-17}{3}$
 d) $4x^2 + 4 = 0$ j) $\frac{2x-3}{7} - \frac{3x-1}{2} \leq x-11$
 e) $4x^2 + 4x = 0$ k) $(3x-1)^2 + (x-1)^2 \geq 10x^2 + 6$
 f) $x^2 = 4x - 1$

9. Prove that each of the following numbers is rational by re-writing them as a fraction of two integers.

a) $0.\overline{304} = 0.304040404\dots$ b) $7.\overline{2673} = 7.2673673673673$ c) $0.\overline{9} = 0.99999\dots$

10. Find each of the following sums.

a) $2 + 4 + 6 + 8 + \dots + 2016$ c) $5 + 10 + 15 + \dots + 2020$ e) $50 + 58 + 66 + \dots + 2018$
 b) $3 + 6 + 9 + \dots + 2016$ d) $30 + 37 + 44 + 51 + \dots + 2018$

11. What is greater, if we add all integers from 1 to 50 or all integers divisible by 10 between 1 and 200?

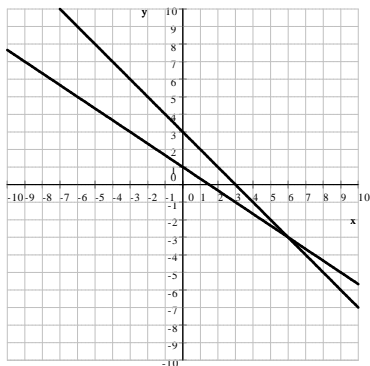
12. The opposite of a number is thirty-five more than the sum of -5 and the number. Find this number.

13. The sum of three consecutive numbers is 63. Find these numbers.
14. Find the sides of the square if we know the following. If we increased the length of each side by 1 feet, the area of the square would increase by 17ft^2 .
15. We have some \$5 bills and some \$10 bills. The number of \$5 bills is ten less than six times the number of \$10. How many \$5 bills do we have if the value of all bills is \$430?
16. We have some \$5 bills and some \$10 bills. How many of each do we have if we have all together 47 bills in the total value of \$425?
17. A number is 42 less than its own square. Find this number.
18. Find all numbers with the following property: if we multiply the number by seven, the result is the original number.
19. We increased a quantity by 40% and then decreased the resulting quantity by 30%. Express the two changes as a single change. What percent of a change is this?
20. Find all numbers with the following property: if we square the number, the result is the original number.
21. We have 320 coins in a jar, all dimes and quarters. How many of each coins do we have if the total value of all coins is \$63.50?
22. Find all numbers with the following property: if we raise the number, to the third power, the result is the original number.
23. One number is twelve less than another. Find these numbers if their product is 160.
24. One number is twelve less than twice another. Find these numbers if their product is 320.
- 25*. Suppose that $A = 2^{99}$. Express each of the following in terms of A .
 - a) 2^{100}
 - b) $2^{99} + 2^{100} - 3 \cdot 2^{101}$
 - c) 8^{99}

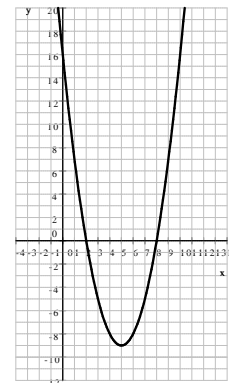
Answers

1. a) $-18, 2$ b) no real solution c) $-\frac{1}{2}, \frac{1}{3}$ d) $\frac{-1 + \sqrt{5}}{2}, \frac{-1 - \sqrt{5}}{2}$

2. $(6, -3)$



3. $y = x^2 - 10x + 16$
 $y = (x - 5)^2 - 9$
 $y = (x - 2)(x - 8)$
 vertex: $(5, -9)$
 y -intercept $(0, 16)$,
 x -intercepts $(2, 0)$ and $(8, 0)$



4. a) $(5, 0)$ b) $(-6, 18)$ c) $(11, 6)$ d) $(4, -1)$

5. a) $\frac{2\sqrt{21}}{7}$ b) $\frac{-\sqrt{2} - 3}{7}$ c) $\frac{\sqrt{10} + 2}{2}$ d) $4 - \sqrt{15}$ e) $\frac{x + 2\sqrt{x}}{x - 4}$ f) $\frac{1}{\sqrt{a} - \sqrt{b}}$

6. a) $3(3a + 8)(a - 2)$ b) $2x(x^2 + 100)$ c) $5x^2(x^2 + 4)(x + 2)(x - 2)$ d) $(x^5 + 7)(x^5 - 7)$

7. a) $\frac{x + 2}{x}$ b) $\frac{1}{2}$ c) -1 d) $-\frac{b^5}{4a^9}$ e) $\frac{15 - \sqrt{6}}{3}$ f) $7x^2\sqrt{3x}$ g) 36

h) 64 i) 1 j) $\frac{12\sqrt{2} + 17}{2}$

8. a) 0, 16 b) -4 c) 1, -1 d) no real solution e) 0, -1 f) $2 - \sqrt{3}, 2 + \sqrt{3}$ g) 7

h) $(-\infty, 0]$ i) $(4, \infty)$ j) $[5, \infty)$ k) $\left(-\infty, -\frac{1}{2}\right]$

9. a) $\frac{301}{990}$ b) $\frac{72601}{9990}$ c) 1

10. a) 1017 072 b) 678 384 c) 409 050 d) 297 936 e) 265 608

11. The sum of all integers divisible by 10 between 1 and 200 is greater ($2100 > 1275$)

12. -15

19. 2% decrease

13. 20, 21, 22

20. 0, 1

14. 8 ft

21. 210 quarters and 110 dimes

15. 12 ten-dollar bills and 62 five-dollar bills

22. 0, 1, -1

16. 38 ten-dollar bills and 9 five-dollar bills

23. -8 with -20 or 8 with 20

17. -6 and 7

24. -10 with -32 and 16 with 20

18. 0

25*. a) $2A$ b) $-9A$ c) A^3