

Quadratic Equations and Applications

Rockswold 3.2

Last updated 2/27/2012

1. Solve exactly $(2x - 317)^2 = 5$
 2. Solve exactly $(207x + 18)^2 = 11$
 3. Solve exactly $(28 - 79x)^2 = 19$
 4. Solve exactly $(315x + 919)^2 = 2$
 5. Solve exactly $(23x - 79)^2 = 29$
 6. Solve exactly $(718 - 37x)^2 = 5$
 7. Solve exactly $(3x + 5)^2 = 2317$
 8. Solve exactly $(1911x - 2)^2 = 5$
 9. Solve exactly $(2x + 1000)^2 = 4$
 10. Solve exactly $(1000x + 9)^2 = 25$
 11. Solve exactly $x^2 + 3x - 2 = 0$
 12. Solve exactly $x^2 + 5x - 7 = 2x - 5$
 13. Solve exactly $2x^2 - 5x + 1 = 0$
 14. Solve exactly $3x^2 - 3x + 5 = x^2 + 2x + 4$
 15. Solve exactly $5x^2 - 9x + 2 = 0$
 16. Solve exactly and simplify $2x^2 - 6x + 3 = 0$
 17. Solve exactly and simplify $2x^2 - 4x + 7 = 2x + 4$
 18. Solve exactly and simplify $x^2 + 2x - 5 = 0$
 19. Solve exactly and simplify $5x^2 + 2x - 1 = 0$
 20. Solve exactly and simplify $x^2 + 5x - 12 = 3x - 7$
 21. Solve exactly and simplify $5x^2 + 7x + 7 = 5x + 8$
 22. Solve exactly and simplify $5x^2 - x + 1 = 2 - 3x$
 23. Find all real and complex roots of $x^2 + 3x + 6 = 0$
 24. Find all real and complex roots of $2x^2 + 5x + 6 = 0$
 25. Find all real and complex roots of $x^2 + 2x + 6 = 0$ and simplify.
- In #26 – 32, solve the equation exactly. Give the answer as a decimal.
26. $3x^2 + 1.5x - 25.92 = 0$.
 27. $5x^2 - 7.5x - 1.7 = 0$
 28. $5x^2 + 2.5x - 4.2 = 0$
 29. $3x^2 + 5.7x + 2.52 = 0$

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30. $3x^2 + 3.9x - 18.24 = 0$

31. $3x^2 - 1.5x - 6.12 = 0$

32. $3x^2 - 8.7x + 6.12 = 0$

33. Solve exactly and simplify $x^2 + 2x - 3 = 1$

34. Solve exactly $3x^2 - 1.2x - 7.56 = 0$.

35. Solve exactly $3x^2 - 7x + 2 = 0$

36. Solve exactly $-5x^2 - 7x + 2 = 0$

37. Solve exactly $5x^2 - 7x - 2 = 2x + 3$

38. Solve exactly $(x - 4)(2x + 7) = 3x + 1$

39. Solve exactly $(x - 4)(2x + 7) = 0$

40. Solve $-227.3x^2 - 119.2x - 5 = -215.6$

41. Solve $227.3x^2 - 119.2x - 5 = 215.6$

42. If producing x tons of a commodity yields a profit (in dollars) of $P(x) = -.02x^2 + 705x - 1,000,000$, Round answers to the nearest unit.

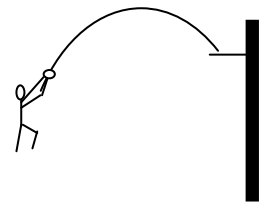
- Find the production level that yields the maximum profit.
- Profits are INCREASING/DECREASING for production in the range from 18000 to 19000.
- Find the maximum profit
- Find the break-even production levels
- Find the production levels that keep profits above \$3,000,000

43. If producing x tons of a commodity yields a profit (in dollars) of $P(x) = -.03x^2 + 505x - 500,000$,

- Find the production level that yields the maximum profit.
- Profits are INCREASING/DECREASING for production in the range from 7000 to 8000.
- Find the maximum profit
- Find the break-even production levels
- Find the production levels that keep profits above \$1,000,000

44. A basketball player takes a jump shot. The height of the ball above the ground is $h(t) = -16t^2 + 30t + 7$ feet t sec after it leaves her hand. The hoop is 11 feet off the ground. Round answer to the nearest tenth.

- What is the maximum height of the ball?
- When does it reach its maximum height?
- Set up an equation that determines when the ball falls to the hoop.
- If the solutions to that equation are $t = 0.104, 2.395$, which is correct?

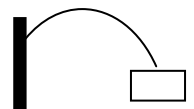


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- 45.** If producing x tons of a commodity yields a profit (in dollars) of $P(x) = -.03x^2 + 805x - 1,000,000$. Round answers to the nearest unit.
- Find the production level that yields the maximum profit.
 - Profits are INCREASING/DECREASING for production in the range from 18000 to 19000.
 - Find the maximum profit
 - Find the break-even production levels
 - Find the production levels that keep profits above \$3,000,000
- 46.** A company makes a profit $P(x) = -0.02x^2 + 450x - 200,000$ dollars for producing x toaster ovens.
- Find the production level that yields the maximum profit.
 - Find the maximum profit.
 - Profits are INCREASING/DECREASING for production in the range from 12000 to 13000.
 - Find the break-even production levels
 - Find the production levels that keep profits above \$2,000,000
- 47.** A company makes a profit $P(x) = -0.02x^2 + 350x - 100,000$ dollars for producing x toaster ovens.
- Maximum profit:
 - Optimum production:
 - For production levels between 9000 and 10000 toaster ovens, profit levels are INCREASING / DECREASING. (Circle one).
 - Find the break-even production levels
 - Find the production levels that keep profits above \$1,000,000
- 48.** Suppose a company makes a profit $P(x) = -0.02x^2 + 620x - 2,000,000$ dollars for selling x computers of a certain model. Rounding to the nearest unit, give
- the maximum profit
 - the optimum production level
 - the production levels that keep profits above \$2,000,000
 - the break-even production levels
- 49.** A place-kicker at a party kicks a football off the second floor balcony. Its height in feet above the ground t seconds after the kick is $h(t) = -16t^2 + 10t + 20$. As the ball falls, it hits the top of a car 6 feet high.
- Set up an equation for the time t when the ball hits the car.
 - How high is the balcony?
 - When is the ball at its maximum height?
 - What is its maximum height?
- 50.** A place-kicker at a party kicks a football off the second floor balcony. Its height in feet above the ground t seconds after the kick is $h(t) = -16t^2 + 30t + 25$. As the ball falls, it breaks a window 20 feet off the ground.
- Set up an equation for the time t when the ball hits the window.
 - When is the ball at its maximum height?
 - What is its maximum height?
 - How high is the balcony?
 - How high is the window?



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Answers:

1. $\frac{317 \pm \sqrt{5}}{2}$

2. $\frac{-18 \pm \sqrt{11}}{207}$

3. $\frac{-28 \pm \sqrt{19}}{-79}$

4. $\frac{-919 \pm \sqrt{2}}{315}$

5. $\frac{79 \pm \sqrt{29}}{23}$

6. $\frac{-718 \pm \sqrt{5}}{-37}$

7. $\frac{-5 \pm \sqrt{2317}}{3}$

8. $\frac{2 \pm \sqrt{5}}{1911}$

9. $\frac{-1000 \pm \sqrt{4}}{2} = \frac{-998}{2}, \frac{-1002}{2} = -449, -501$

10. $\frac{-9 \pm \sqrt{25}}{1000} = \frac{-4}{1000}, \frac{-14}{1000} = -0.004, -0.014$

11. $\frac{-3 \pm \sqrt{17}}{2}$

12. $\frac{-3 \pm \sqrt{17}}{2}$

13. $\frac{5 \pm \sqrt{17}}{4}$

14. $\frac{5 \pm \sqrt{17}}{4}$

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15. $\frac{9 \pm \sqrt{41}}{10}$

16. $\frac{3 \pm \sqrt{3}}{2}$

17. $\frac{3 \pm \sqrt{3}}{2}$

18. $-1 \pm \sqrt{6}$

19. $\frac{-1 \pm \sqrt{6}}{5}$

20. $-1 \pm \sqrt{6}$

21. $\frac{-1 \pm \sqrt{6}}{5}$

22. $\frac{-1 \pm \sqrt{6}}{5}$

23. $\frac{-3 \pm i\sqrt{15}}{2}$

24. $\frac{-5 \pm i\sqrt{23}}{4}$

25. $-1 \pm i\sqrt{5}$

26. 2.7, -3.2

27. 1.7, -0.2

28. 0.7, -1.2

29. -0.7, -1.2

30. 1.9, -3.2

31. 1.7, -1.2

32. 1.7, 1.2

33. $-1 \pm \sqrt{5}$

34. 1.8, -1.4

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$$35. \frac{7 \pm \sqrt{7^2 - 4 \cdot 3 \cdot 2}}{6} = \frac{7 \pm \sqrt{25}}{6} = \frac{7 \pm 5}{6} = 2, 1/3$$

Alt solution: $3x^2 - 7x + 2 = (3x - 1)(x - 2) = 0$

$$36. \frac{7 \pm \sqrt{7^2 - 4 \cdot -5 \cdot 2}}{2 \cdot -5} = \frac{7 \pm \sqrt{89}}{-10} \text{ are the exact solutions}$$

$(7 \pm \sqrt{(7^2 - 4 \cdot -5 \cdot 2)}) / (2 \cdot -5) = 2.43398113, -1.643398$ are the precise solutions

$$37. 5x^2 - 9x - 5 = 0$$

$$\frac{9 \pm \sqrt{9^2 - 4 \cdot 5 \cdot -5}}{2 \cdot 5} = \frac{9 \pm \sqrt{181}}{10} \quad \text{exact}$$

$(9 \pm \sqrt{(9^2 - 4 \cdot 5 \cdot -5)}) / (2 \cdot 5) = 2.2453, -0.44536$ precise

$$38. 2x^2 - x - 28 = 3x + 1 \quad 2x^2 - 4x - 29 = 0$$

$$\frac{4 \pm \sqrt{4^2 - 4 \cdot 2 \cdot -29}}{2 \cdot 2} = \frac{4 \pm \sqrt{248}}{2 \cdot 2} = \frac{4 \pm 2\sqrt{62}}{2 \cdot 2} = \frac{2 \pm \sqrt{62}}{2} \quad \text{exact}$$

$$39. x = 4, -7/2$$

$$40. -227.3x^2 - 119.2x + 205.6 = 0$$

$(119.2 \pm \sqrt{(119.2^2 - 4 \cdot -227.3 \cdot 205.6)}) / (2 \cdot -227.3) = -1.248760496, 0.24343426$

$$41. 227.3x^2 - 119.2x - 220.6 = 0$$

$(119.2 \pm \sqrt{(119.2^2 - 4 \cdot 227.3 \cdot -220.6)}) / (2 \cdot 227.3) = -1.2816578, -0.7572407$

42. If producing x tons of a commodity yields a profit (in dollars) of $P(x) = -.02x^2 + 705x - 1,000,000$,

a. Find the production level that yields the maximum profit. 17625

b. Profits are **INCREASING/DECREASING** for production in the range from 18000 to 19000.

c. Find the maximum profit \$5,212,812.5

d. Find the break-even production levels 33,769.4, 1480.6

e. Find the production levels that keep profits above \$3,000,000

Between 7106.4 and 28143.6

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43. If producing x tons of a commodity yields a profit (in dollars) of

$$P(x) = -.03x^2 + 505x - 500,000,$$

- Find the production level that yields the maximum profit. 8416.7
- Profits are INCREASING/DECREASING for production in the range from 7000 to 8000.
- Find the maximum profit \$1,625,208.3
- Find the break-even production levels 1056.4, 15776.9
- Find the production levels that keep profits above \$1,000,000
Between 3851.6 and 12981.8

44. A basketball player takes a jump shot. The height of the ball above the ground is $h(t) = -16t^2 + 30t + 7$ feet t sec after it leaves her hand. The hoop is 11 feet off the ground. Round answer to the nearest tenth.

- max height: 21.0625
 $h(0.9375) = 21.0625$
- When does it reach its maximum height?
 $t_{\max} = 0.9375$

$$\frac{-b}{2a} = 0.9375$$

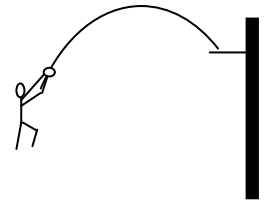
- $-16t^2 + 30t + 7 = 11$
- If the solutions to that equation are $t = 0.104$, 2.395, which is correct?

45. If producing x tons of a commodity yields a profit (in dollars) of $P(x) = -.03x^2 + 805x - 1,000,000$. Round answers to the nearest unit.

- optimum production: 13416.7
 $\frac{-b}{2a} = 13416.7$
- maximum profit: 4400208
 $P(13416.7) = 4400208$
- Profits are INCREASING/DECREASING for production in the range from 14000 to 15000.
- 1305.8, 25527.6
- Between 6584.9 and 20,248.5

46. A company makes a profit $P(x) = -0.02x^2 + 450x - 200,000$ dollars for producing x toaster ovens.

- optimum production: 11250
 $\frac{-b}{2a} = 11250$
- maximum profit: 2331250
- Profits are INCREASING/DECREASING for production in the range from 12000 to 13000.
- 453.6, 22046.4
- Between 7180.3 and 15,319.7



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47. A company makes a profit $P(x) = -0.02x^2 + 350x - 100,000$ dollars for producing x toaster ovens.

- a. Maximum profit: 1,431,250
- b. Optimum production: 8750
- c. DECREASING
- d. 290.6, 17209.5
- e. Between 4106.5 and 13393.6

48. Suppose a company makes a profit $P(x) = -0.02x^2 + 620x - 2,000,000$ dollars for selling x computers of a certain model. Rounding to the nearest unit, give

- a. the maximum profit: 2805000

$$P\left(-\frac{b}{2a}\right) = P(15500) = -0.02(15500)^2 + 620(15500) - 2,000,000$$

- b. the optimum production level: $-\frac{b}{2a} = -620/(2 \cdot -0.02) = 15500$

- c. Between 9155.7 and 218444.3

- d. 3657.3, 27342.7

49. $h(t) = -16t^2 + 30t + 20$

- a. $-16t^2 + 30t + 25 = 6$

- b. 20 ft

- c. $t = 5/16$ sec

- d. 21.56 ft

50. $h(t) = -16t^2 + 30t + 25$

- a. $-16t^2 + 30t + 25 = 20$

- b. $t = 0.9375$ sec = $15/16$ sec

- c. 44.0625 feet = $705/16$ feet

- d. 25 ft

- e. 20 ft

