Unit 5 – Solving Quadratic Equations

Workbook

MPM2D

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

W1 –Solving Quadratics by Factoring Unit 5

MPM2D

Jensen

1) Solve

a) $(x+1)(x+2)=0$

b) $(x+3)(x-1)=0$

c) $x(4-x)=0$

d) $(2x+1)(x-3)=0$

2) Solve and check

a) $x^2+7x+12=0$

b) $x^2-x-6=0$

c) $x^2-8x+16=0$

f) $x^2-7x=18$

3) Solve

a) $2a^2 + 3a - 2 = 0$

b) $3s^2 - 4s + 1 = 0$

c) $2t^2 + 11t + 5 = 0$

d) $3x^2 + 7x - 6 = 0$

e) $3 = 4m^2 - 4m$

f) $10y^2 - 16y = -6$

g) $x^2 + 2x = 0$

h) $3x^2 + 2x = 0$

i) $5x^2 - 20x = 0$

j) $0 = 4x + 3x^2$

k) $x^2 - 25 = 0$

l) $x^2 + 4 = 16$

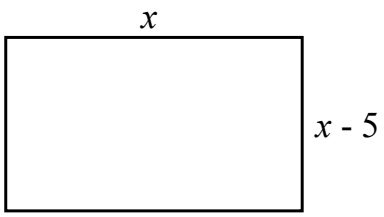
m) $x^2 - 2x - 11 = 4$

n) $5x^2 = 2x$

o) $(x + 4)^2 = 4$

p) $(x - 6)^2 - 8x = 0$

4) The area of the rectangle shown in the diagram is 36 cm^2. What are its dimensions?



5) A photograph measuring 12 cm by 8 cm is to be surrounded by a mat before framing. The width of the mat is to be the same on all sides of the photograph. The area of the mat is to equal the area of the photograph. Find the width of the mat.

6) Three times the square of an integer is 432. Find the integer.

7) A regular polygon with n sides has $\frac{n(n-3)}{2}$ diagonals. Find the number of sides of a regular polygon that has 44 diagonals.

Answers

1)a) $x = -2, -1$ **b)** $x = -3{,}1$ **c)** $x = 0{,}4$ **d)** $x = -\frac{1}{2}, 3$
2)a) $x = -4, -3$ **b)** $x = -2{,}3$ **c)** $x = 4$ **d)** $x = -2{,}9$
3)a) $a = -2, \frac{1}{2}$ **b)** $s = \frac{1}{3}, 1$ **c)** $t = -5, -\frac{1}{2}$ **d)** $x = -3, \frac{2}{3}$ **e)** $m = -\frac{1}{2}, \frac{3}{2}$ **f)** $y = \frac{3}{5}, 1$ **g)** $x = -2{,}0$
h) $x = -\frac{2}{3}, 0$ **i)** $x = 0{,}4$ **j)** $x = -\frac{4}{3}, 0$ **k)** $x = -5{,}5$ **l)** $x = \pm\sqrt{12} = \pm 2\sqrt{3} \cong \pm 3.46$ **m)** $x = -3{,}5$
n) $x = 0, \frac{2}{5}$ **o)** $x = -6, -2$ **p)** $x = 2{,}18$
4) 9 cm by 4 cm
5) 2 cm
6) 12 or -12
7) 11

W2 –Solving Quadratics by Completing the Square Unit 5

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1) Solve each equation by completing the square. Round answers to 2 decimal places where necessary.

a) $x^2 + 14x - 38 = 0$

b) $x^2 + 6x - 59 = 0$

c) $x^2 + 14x - 51 = 0$

d) $x^2 - 12x + 11 = 0$

e) $x^2 + 6x + 8 = 0$

f) $x^2 - 12x + 23 = 0$

g) $x^2 - 6x = -91$

h) $8x^2 + 16x = 42$

i) $4x^2 + 4x + 36 = 0$

j) $3x^2 + 5x - 4 = 0$

Answers

1)a) $x = -16.33, 2.33$ **b)** $x = -11.25, 5.25$ **c)** $x = -17, 3$ **d)** $x = 1, 11$ **e)** $x = -4, -2$ **f)** $x = 2.39, 9.61$
g) no real solutions **h)** $x = -\frac{7}{2}, \frac{3}{2}$ **i)** no real solutions **j)** $x = -2.26, 0.59$

W3 –Solving Quadratics using the Quadratic Formula Unit 5

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1) Use the quadratic formula to solve each equation. Express answers as approximate roots rounded to 2 decimal places.

a) $7x^2 + 24x + 9 = 0$

b) $2x^2 + 4x - 7 = 0$

c) $4x^2 - 12x + 9 = 0$

d) $2x^2 - 7x = -4$

e) $3x^2 + 5x = 1$

f) $16x^2 + 24x = -9$

2) Use the quadratic formula to solve. Express your answers as approximate roots, rounded to the nearest hundredth.

a) $3x^2 + 14x + 5 = 0$

b) $8x^2 + 12x + 1 = 0$

c) $4x^2 - 7x - 1 = 0$

d) $10x^2 - 45x - 7 = 0$

e) $-5x^2 + 16x - 2 = 0$

f) $-6x^2 + 17x + 5 = 0$

g) $x^2 + 5x + 2 = 0$

h) $5x^2 - 3x + 2 = 0$

3) Describe the roots of the equation $ax^2 + bx + c = 0$ in each of the following situations. Explain and justify your reasoning, and give examples to support your answers.

a) $b^2 - 4ac < 0$

b) $b^2 - 4ac = 0$

c) $b^2 - 4ac > 0$ and is a perfect square

d) $b^2 - 4ac > 0$ and is NOT a perfect square

4) Use the discriminant to determine the number of roots for each quadratic equation.

a) $x^2 - 10x + 25 = 0$

b) $3x^2 + 4x + \frac{4}{3} = 0$

c) $2x^2 - 8x + 9 = 0$

d) $-2x^2 + 0.75x + 5 = 0$

Answers

1)a) $-3, \frac{-3}{7}$ **b)** $\frac{-4\pm\sqrt{72}}{4} = \frac{-2\pm3\sqrt{2}}{2}; 1.12, -3.12$ **c)** $\frac{3}{2}$ **d)** $\frac{7\pm\sqrt{17}}{4}; 2.78, 0.72$ **e)** $\frac{-5\pm\sqrt{37}}{6}; 0.18, -1.85$ **f)** $\frac{-3}{4}$

2)a) $\frac{-7\pm\sqrt{34}}{3}; -0.39, -4.28$ **b)** $\frac{-3\pm\sqrt{7}}{4}; -0.09, -1.41$ **c)** $\frac{7\pm\sqrt{65}}{8}; 1.88, -0.13$

d) $\frac{45\pm\sqrt{2305}}{20}; 4.65, -0.15$ **e)** $\frac{-16\pm\sqrt{216}}{-10} = \frac{8\pm3\sqrt{6}}{5}; 0.13, 3.07$ **f)** $\frac{17\pm\sqrt{409}}{12}; 3.1, -0.27$

g) $\frac{-5\pm\sqrt{17}}{2}; -0.44, -4.56$ **h)** no real solutions

3)a) no real solutions **b)** 1 real solution **c)** 2 real rational solutions **d)** 2 real irrational solutions

4)a) one **b)** one **c)** none **d)** two

W4 –Quadratics in Standard Form Unit 5

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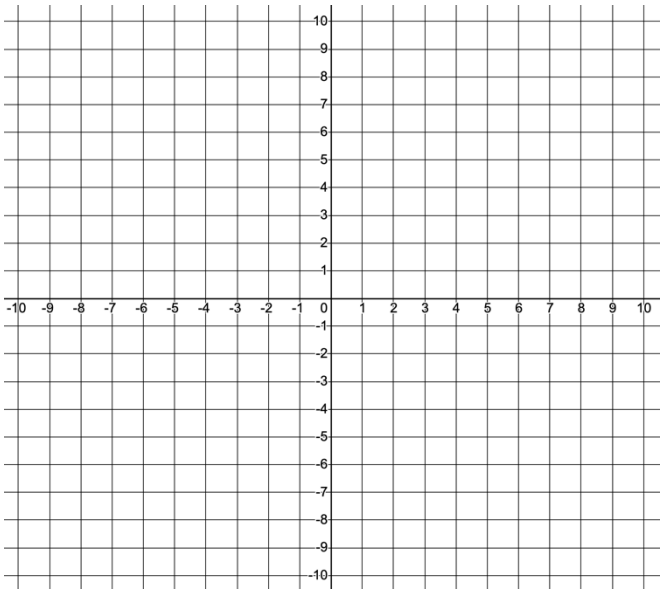
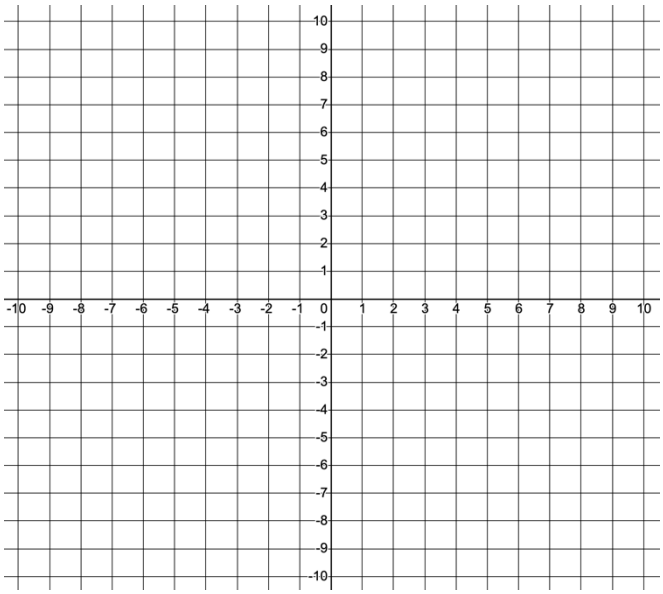
1) Find the x-intercepts and the vertex of each parabola. Then, sketch its graph.

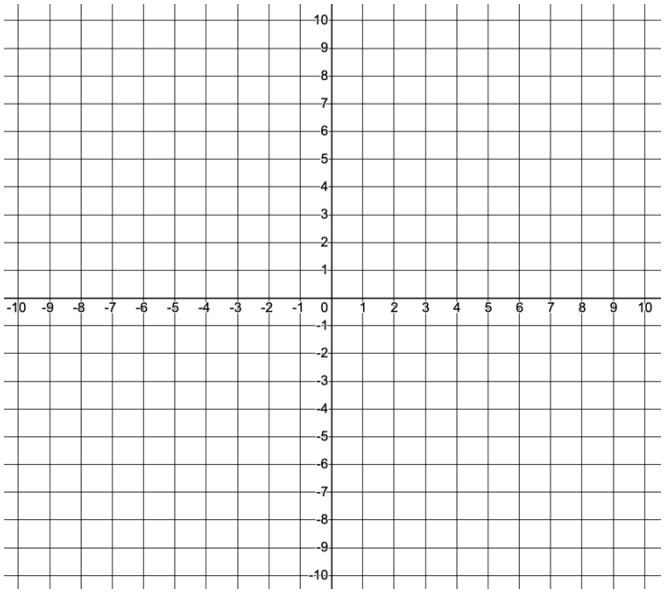
a) $y = x^2 - 6x + 8$



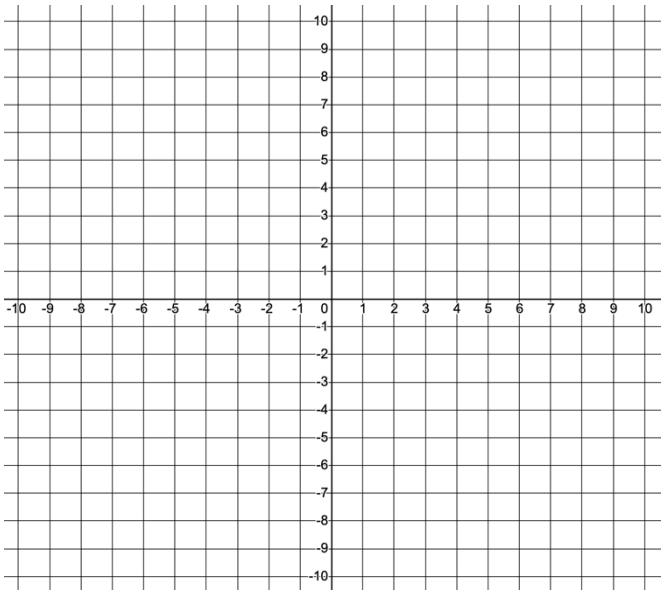
b) $y = -x^2 - 4x + 5$



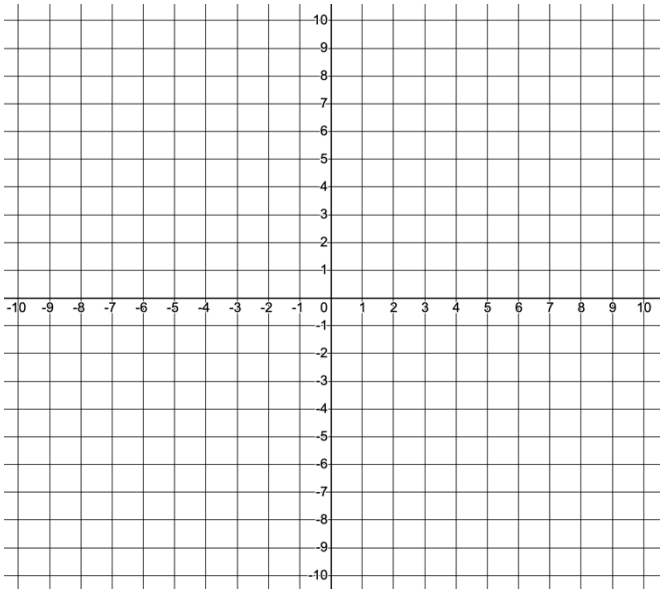
c) $y = x^2 - 9$



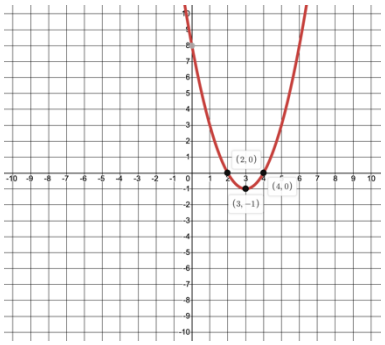
d) $y = x^2 - 12x + 36$



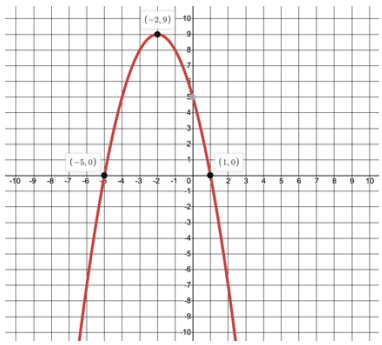
e) $y = 2x^2 - 3x + 4$



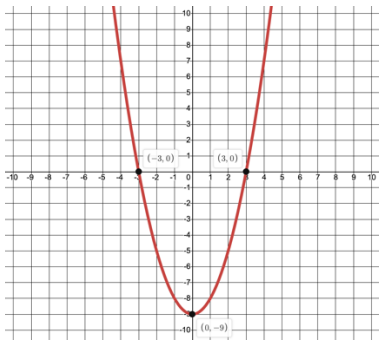
1)a)



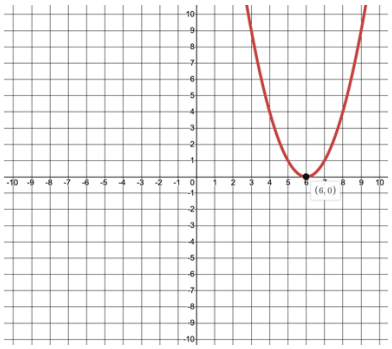
b)



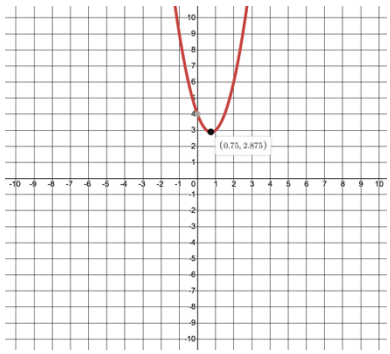
c)



d)



e)



W5 – Applications of Quadratics Unit 5
MPM2D
Jensen

1) A model rocket is launched from the deck in Jim's backyard and the path followed by the rocket can be modelled by the relation $h = -5t^2 + 100t + 15$, where h, in meters, is the height that the model rocket reaches after t seconds.

a) What is the height of the deck?

b) What is the height of the model rocket after 2 s?

c) What is the maximum height reached by the model rocket?

d) How long did the model rocket take to reach this height?

e) How long was the model rocket above 200 m?

f) How long the model rocket was in the air.

2) A harbour ferry service has about 240 000 riders per day for a fare of $2. The port authority wants to increase the fare to help with increasing operational costs. Research has shown that for every $0.10 increase in the fare the number of riders will drop by 10 000.

a) What increase in the fare will maximize the revenue?

b) What is the new fare?

c) What is the revenue that will be received from the new fare?

3) A rectangular lawn measures 30 m by 40 m. Jason is cutting the lawn from the outside perimeter in toward the center by cutting strips along the entire perimeter first, then continuing as he cuts toward the center. How wide is the strip that has been cut along the outside when the area is half cut?

4) The hypotenuse of a right triangle measures 13 cm. The legs of the triangle differ by 7 cm. Find the length of each leg.

5) A triangle has an area of 308 cm^2. If the base is 2 cm more than three times the height of the triangle, find the base and height of the triangle.

6) The sum of the squares of four consecutive integers is 630. Find the integers.

7) Twice the width of a rectangle is 3 m more than the length. If the area of the rectangle is 209 m^2, find the dimensions of the rectangle.

8) A rectangular carpet and a square carpet have equal areas. The square carpet has a side length of 4 meters. The length of the rectangular carpet is 2 meters less than three times its width. Find the dimensions of the rectangular carpet.

Answers

1)a)15 m **b)**195 m **c)** 515 m **d)**10 s **e)** 15.874 s **f)** 20.15 s
2)a) \$0.20 **b)** \$2.20 **c)** \$484 000
3) 5 m
4) 12 cm and 5 cm
5) base 44 cm, height 14 cm
6) 11, 12, 13, 14 or –14, –13, –12, –11
7) width 11 m, length 19 m
8) $\frac{8}{3}$ m by 6 m