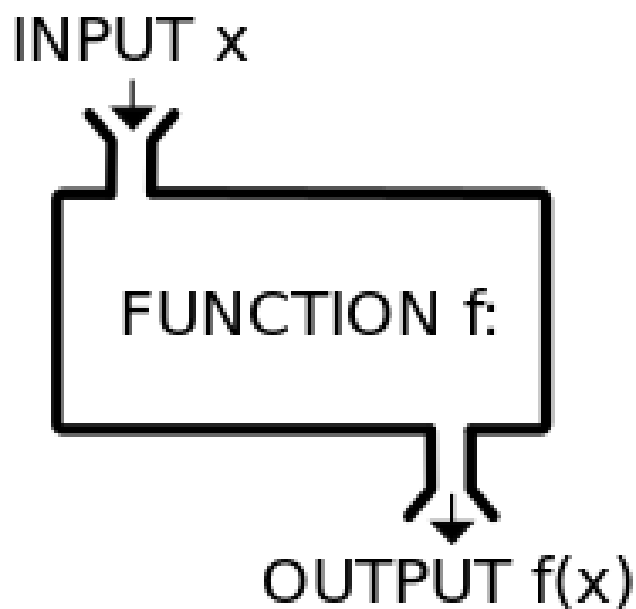


Chapter 1- Functions

Workbook Package

MCR3U



Chapter 1 Workbook Checklist

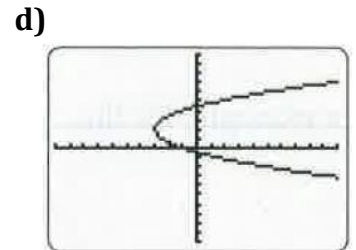
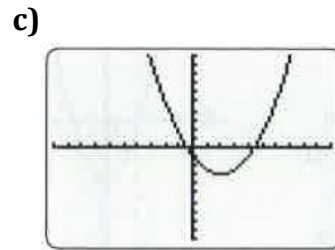
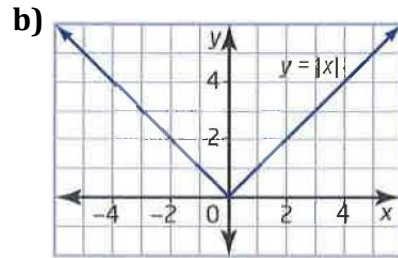
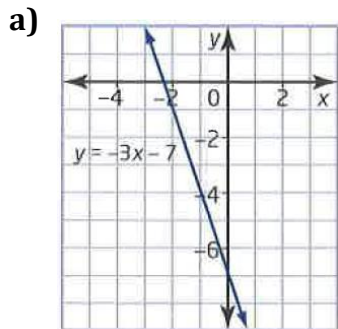
Worksheet	Check
1.1 – Functions, Domain, and Range	
1.2 – Functions and Function Notation	
1.3 – Max or Min of a Quadratic Function	
1.3 – Extra Practice (optional)	
1.4 – Working with Radicals	
1.5 – Solving Quadratic Equations – Part 1: Factoring	
1.5 – Solving Quadratic Equations – Part 2: QF	
1.7 – Solve Linear Quadratic Systems	
Chapter 1 Review	
Chapter 1 Mini Practice Test	

W1 - 1.1 Functions, Domain, and Range

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Jensen

1) Which graphs represent functions? Justify your answer.



2) Is each relation a function? Explain and make a rough sketch of the graph of each.

a) $y = x - 5$

b) $y = 2(x - 1)^2 - 2$

c) $x^2 + y^2 = 4$

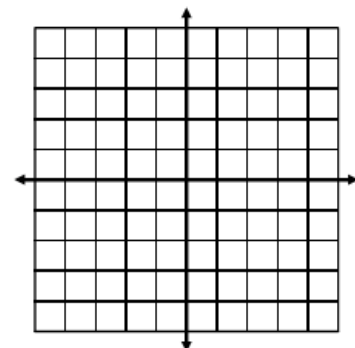
3) State the domain and range. Represent as a table and graph. Then state if it is a function.

a) $\{(-5, 4), (-4, -1), (-2, 1), (0, 4), (1, 3)\}$

Domain:

Range:

x	y



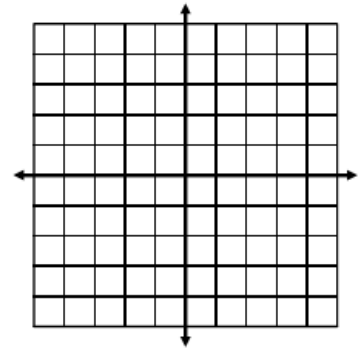
Is this relation a function?

b) $\{(-3, -4), (-1, 2), (0, 0), (-3, 5), (2, 4)\}$

Domain:

Range:

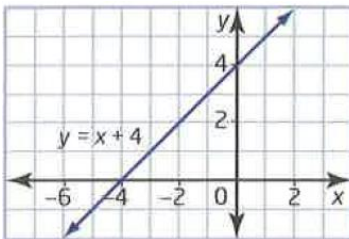
x	y



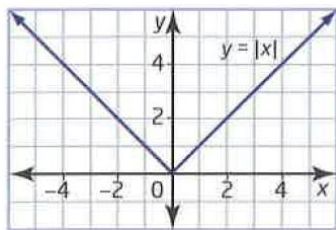
Is this relation a function?

4) State the domain and range of each relation. Then state if the relation is a function.

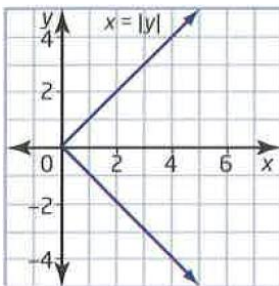
a)



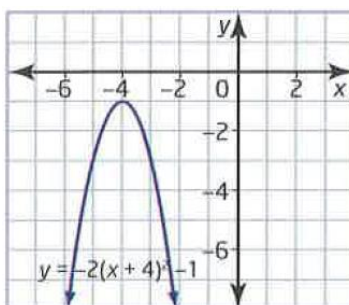
b)



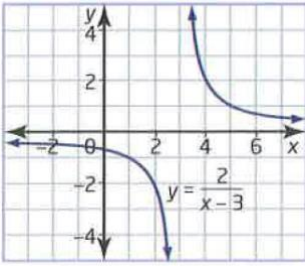
c)



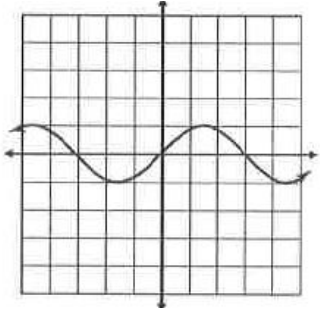
d)



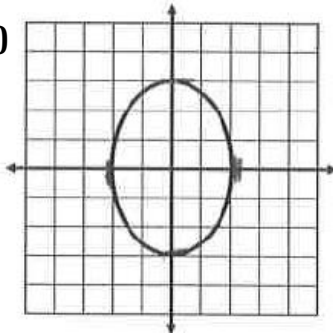
e)



f)



g)

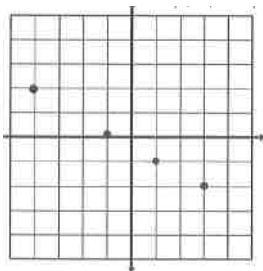


5) Which of the following relations are functions?

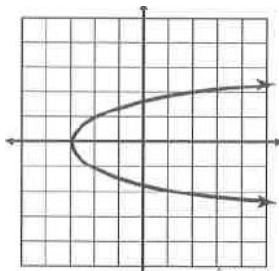
a)

x	y
2	-3
-1	0
5	5
3	2
2	1

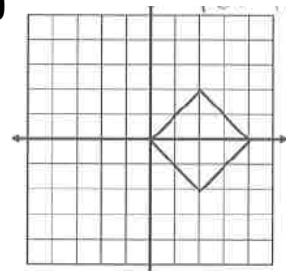
b)



c)



d)



6) Determine the domain and range of each of the following relations. Use a graphing calculator or a graphing app to help if necessary. Make a rough sketch of the graph.

a) $y = -x + 3$

b) $y = (x + 1)^2 - 4$

c) $y = -3x^2 + 1$

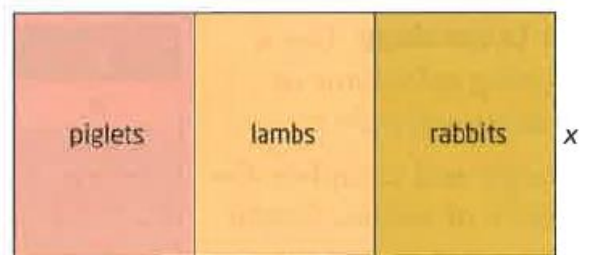
d) $x^2 + y^2 = 9$

e) $y = \frac{1}{x+3}$

f) $y = \sqrt{2x + 1}$

7) Pam has 90 m of fencing to enclose an area in a petting zoo with two dividers to separate three types of young animals. The three pens are to have the same area.

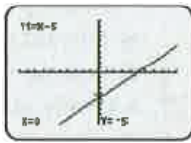
- a) Express the area function for the three pens in terms of x .
b) Determine the domain and range for the area function.



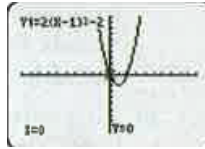
Answers

1) a, b, and c are functions. d is not a function.

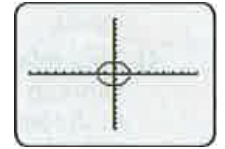
2) a) function



b) function

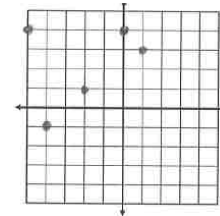


c) not a function



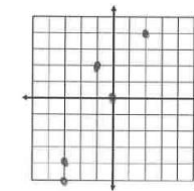
3) a) D: $\{x = -5, -4, -2, 0, 1\}$ R: $\{y = -1, 1, 3, 4\}$

x	y
-5	4
-4	-1
-2	1
0	4
1	3



b) D: $\{x = -3, -1, 0, 2\}$ R: $\{y = -4, 0, 2, 4, 5\}$

x	y
-3	-4
-1	2
0	0
-3	5
2	4



4) a) D: $\{X \in \mathbb{R}\}$

R: $\{Y \in \mathbb{R}\}$

this relation is a function

b) D: $\{X \in \mathbb{R}\}$

R: $\{Y \in \mathbb{R} | y \geq 0\}$

this relation is a function

c) D: $\{X \in \mathbb{R} | x \geq 0\}$

R: $\{Y \in \mathbb{R}\}$

this relation is NOT a function

d) D: $\{X \in \mathbb{R}\}$

R: $\{Y \in \mathbb{R} | y \leq -1\}$

this relation is a function

e) D: $\{X \in \mathbb{R} | x \neq 3\}$

R: $\{Y \in \mathbb{R} | y \neq 0\}$

this relation is a function

f) D: $\{X \in \mathbb{R}\}$

R: $\{Y \in \mathbb{R} | -1 \leq y \leq 1\}$

this relation is a function

g) D: $\{X \in \mathbb{R} | -2 \leq x \leq 2\}$

R: $\{Y \in \mathbb{R} | -3 \leq y \leq 3\}$

this relation is NOT a function

5) b is the only relation that is a function

6) a) domain $\{x \in \mathbb{R}\}$, range $\{y \in \mathbb{R}\}$

b) domain $\{x \in \mathbb{R}\}$, range $\{y \in \mathbb{R}, y \geq -4\}$

c) domain $\{x \in \mathbb{R}\}$, range $\{y \in \mathbb{R}, y \leq 1\}$

d) domain $\{x \in \mathbb{R}, -3 \leq x \leq 3\}$;
range $\{y \in \mathbb{R}, -3 \leq y \leq 3\}$

e) domain $\{x \in \mathbb{R}, x \neq -3\}$, range $\{y \in \mathbb{R}, y \neq 0\}$

f) domain $\{x \in \mathbb{R}, x \geq -0.5\}$, range $\{y \in \mathbb{R}, y \geq 0\}$

7) a) $A = -2x^2 + 45x$ b) D: $\{X \in \mathbb{R} | 0 < x < 22.5\}$ R: $\{Y \in \mathbb{R} | 0 < y \leq 253.1\}$

W2 - 1.2 Functions and Function Notation

MCR3U

Jensen

1) For each function, determine $f(4)$, $f(-5)$, and $f\left(-\frac{2}{3}\right)$.

a) $f(x) = \frac{2}{5}x + 11$

b) $f(x) = 3x^2 + 2x + 1$

c) $f(x) = 2(x + 4)^2$

d) $f(x) = -6$

e) $f(x) = \frac{1}{x}$

f) $f(x) = \sqrt{x + 5}$

2) If $f(x) = x^2 + 2$, state the following.

a) $f(1)$

b) $f(0)$

c) $f(2)$

d) $f(-2)$

e) $f(3)$

f) $f\left(\frac{1}{2}\right)$

3) State $f(4)$ for each of the following functions.

a) $f(x) = 4 + 5x$

b) $f(x) = x^2 - 6$

c) $f(t) = 9 - t$

d) $f(x) = 10$

e) $f(z) = z^3$

f) $f(x) = 8(5 - x)$

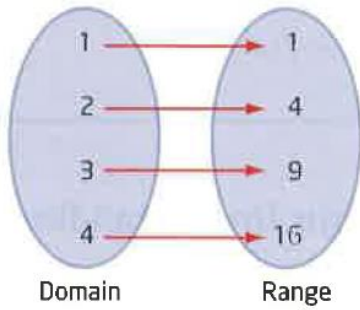
g) $f(x) = \frac{1}{x}$

h) $f(x) = \sqrt{13 - x}$

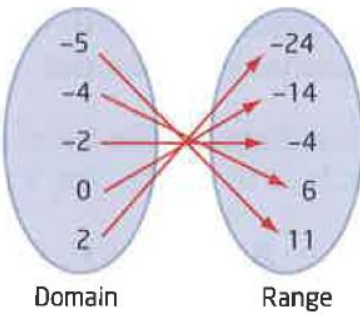
i) $f(t) = \frac{1}{t^2}$

4) Write the ordered pairs associated with each mapping diagram. Then state if the relation is a function.

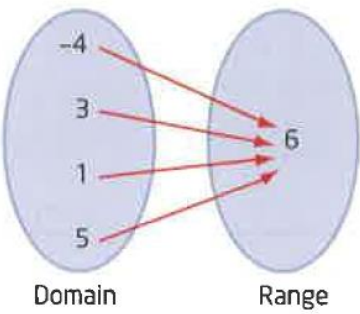
a)



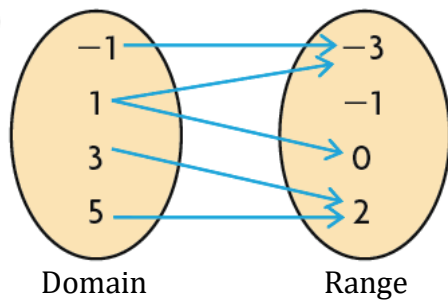
b)



c)



d)



5) Show each set of data in a mapping diagram. Then state if the relation is a function.

a) $\{(1, 4), (2, 1), (3, -2), (4, -5), (5, -8), (6, -11), (7, -14), (8, -17)\}$

b) $\{(-3, 4), (-2, -1), (-1, -4), (0, -5), (1, -4), (2, -1)\}$

c) $\{(-5, 6), (-4, 9), (-3, 1), (-5, -6), (1, -2), (3, 8), (8, 8)\}$

d) $\{(9, 9), (7, 9), (5, 9), (3, 9)\}$

6) State the domains of the following functions

a) $f(x) = \sqrt{8 - x}$

b) $f(x) = \frac{x^2+3}{(x-1)(x+3)}$

Answers

1) a) $\frac{63}{5}, 9, \frac{161}{15}$ b) 57, 66, 1 c) 128, 2, $\frac{200}{9}$ d) -6, -6, -6 e) $\frac{1}{4}, -\frac{1}{5}, -\frac{3}{2}$ f) 3, 0, $\sqrt{\frac{13}{3}}$

2) a) 3 b) 2 c) 6 d) 6 e) 11 f) $\frac{9}{4}$

3) a) 24 b) 10 c) 5 d) 10 e) 64 f) 8 g) $\frac{1}{4}$ h) 3 i) $\frac{1}{16}$

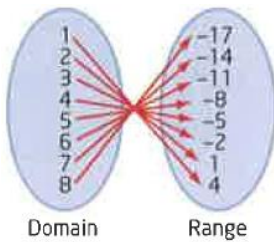
4) a) $\{(1, 1), (2, 4), (3, 9), (4, 16)\}$ this relation is a function

b) $\{(-5, 11), (-4, 6), (-2, -4), (0, -14), (2, -24)\}$ this relation is a function

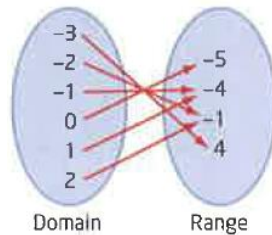
c) $\{(-4, 6), (3, 6), (1, 6), (5, 6)\}$ this relation is a function

d) $\{(-1, -3), (1, -3), (1, 0), (3, 2), (5, 2)\}$ this relation is NOT a function

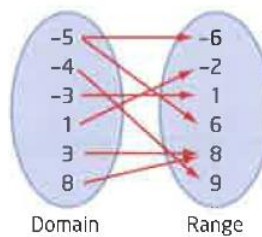
5) a) function



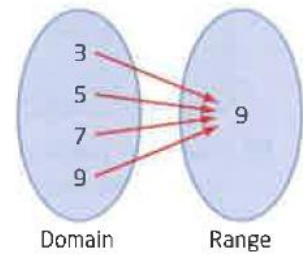
b) function



c) Not a function



d) function



6) a) $\{X \in \mathbb{R} | x \leq 8\}$ b) $\{X \in \mathbb{R} | x \neq 1, x \neq -3\}$

W3a - 1.3 Max or Min of a Quadratic Function

MCR3U

Jensen

1) Determine the vertex for each quadratic function by completing the square. State if the vertex is a maximum or a minimum.

a) $f(x) = x^2 + 14x - 14$

b) $f(x) = x^2 - 6x + 17$

c) $f(x) = x^2 + 7x + 11$

d) $f(x) = 2x^2 + 12x + 16$

e) $f(x) = -3x^2 + 6x + 1$

f) $f(x) = -\frac{1}{2}x^2 - x + \frac{3}{2}$

2) Use partial factoring to determine the vertex of each function. State if the vertex is a max or min.

a) $f(x) = 3x^2 - 6x + 11$

b) $f(x) = -2x^2 + 8x - 3$

c) $h(x) = -x^2 + 2x + 4$

d) $f(x) = 2x^2 + 12x + 17$

e) $f(x) = 4x^2 + 64x + 156$

f) $f(x) = \frac{1}{2}x^2 - 3x + 8$

3) An electronics store sells an average of 60 entertainment systems per month at an average of \$800 more than the cost price. For every \$20 increase in the selling price, the store sells one fewer system. What amount over the cost price will maximize revenue?

4) Last year, a banquet hall charged \$30 per person, and 60 people attended the hockey banquet dinner. This year, the hall's manager has said that for every 10 extra people that attend the banquet, they will decrease the price by \$1.50 per person. What size group would maximize the profit for the hall this year and what would the maximum profit be?

5) The path of a rocket is given by the function, $h(t) = -3t^2 + 30t + 73$, where 'h' is the height in meters and 't' is the time in seconds.

a) What is the maximum height of the rocket?

b) At what time does the rocket reach its maximum height?

Answers

1) a) (-7,-63) min b) (3,8) min c) $(\frac{-7}{2}, \frac{-5}{4})$ min d) (-3, -2) min e) (1, 4) max f) (-1, 2) max

2) a) (1, 8) min b) (2, 5) max c) (1, 5) max d) (-3, -1) min e) (-8, -100) min f) $(3, \frac{7}{2})$ min

3) \$1000

4) A group of 130 would give a max profit of \$2535

5) a) 148 m b) 5 seconds

W3B - 1.3 Extra Practice

MCR3U

Jensen

1. Find the vertex of each quadratic by completing the square

a) $y = x^2 + 16x + 71$

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

c) $y = -x^2 - 14x - 59$

d) $y = 2x^2 + 36x + 170$

e) $y = x^2 - 12x + 46$

f) $y = x^2 + 4x$

g) $y = x^2 - 6x + 5$

2. Find the vertex of each quadratic using the method of partial factoring

a) $y = x^2 + 9x + 20$

b) $y = 2x^2 - 28x + 94$

c) $y = -6x^2 - 12 - 13$

d) $y = -9x^2 - 162x - 731$

e) $y = -x^2 + 12x - 40$

f) $y = x^2 + 10x + 33$

g) $y = x^2 + 6x + 3$

Answers

1) a) (-8, 7) b) (1, -6) c) (-7, -10) d) (-9, 8) e) (6, 10) f) (-2, -4) g) (3, -4)

2) a) $\left(-\frac{9}{2}, -\frac{1}{4}\right)$ b) (7, -4) c) (-1, -7) d) (-9, -2) e) (6, -4) f) (-5, 8) g) (-3, -6)

W4 - 1.4 Working with Radicals

MCR3U

Jensen

1) Simplify

a) $3(4\sqrt{5})$

b) $\sqrt{5}(-2\sqrt{7})$

c) $2\sqrt{3}(3\sqrt{2})$

2) Express each as a mixed radical in simplest form

a) $\sqrt{12}$

b) $\sqrt{147}$

c) $\sqrt{252}$

3) Simplify

a) $2\sqrt{3} - 5\sqrt{3} + 4\sqrt{3}$

b) $11\sqrt{5} - 4\sqrt{5} - 5\sqrt{5} - 6\sqrt{5}$

c) $\sqrt{6} - 4\sqrt{2} + 3\sqrt{6} - \sqrt{2}$

d) $2\sqrt{10} - \sqrt{10} - 4\sqrt{10} + \sqrt{5}$

4) Add or subtract as indicated

a) $8\sqrt{2} - 4\sqrt{8} + \sqrt{32}$

b) $\sqrt{20} - 4\sqrt{12} - \sqrt{125} + 2\sqrt{3}$

c) $5\sqrt{3} - \sqrt{72} + \sqrt{243} + \sqrt{8}$

d) $\sqrt{44} + \sqrt{88} + \sqrt{99} + \sqrt{198}$

5) Expand and simplify

a) $5\sqrt{6}(2\sqrt{3})$

b) $8\sqrt{5}(\sqrt{10})$

c) $11\sqrt{2}(5\sqrt{3})$

6) Expand and simplify where possible

a) $3(8 - \sqrt{5})$

b) $\sqrt{3}(\sqrt{6} - \sqrt{3})$

c) $8\sqrt{2}(2\sqrt{8} + 3\sqrt{12})$

7) Expand and simplify where possible

a) $(\sqrt{2} + 5)(\sqrt{2} + 5)$

b) $(\sqrt{3} + 2\sqrt{2})(5 + 5\sqrt{2})$

c) $(1 + \sqrt{5})(1 - \sqrt{5})$

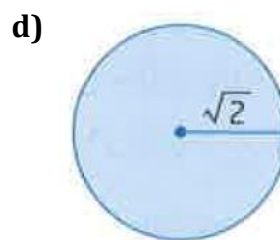
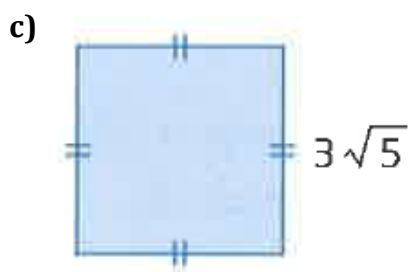
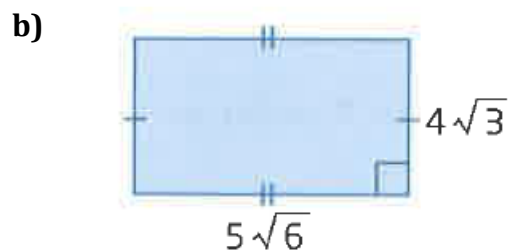
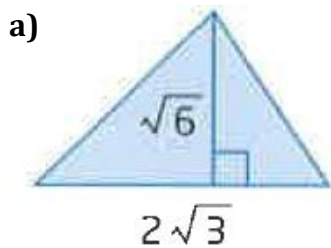
d) $(4 - 3\sqrt{7})(\sqrt{7} + 1)$

8) Simplify

a) $\frac{1}{4}\sqrt{54} - \frac{1}{4}\sqrt{150}$

b) $\frac{1}{2}\sqrt{8} + \frac{3}{5}\sqrt{50} - \frac{2}{3}\sqrt{18}$

9) Find a simplified expression for the area of each shape



10) Find the area and perimeter of the rectangle shown. Express your answer in simplified radical form.



11) Simplify each of the following

a) $\frac{21-7\sqrt{6}}{7}$

b) $\frac{12-\sqrt{48}}{4}$

Answers

1) a) $12\sqrt{5}$ b) $-2\sqrt{35}$ c) $6\sqrt{6}$

2) a) $2\sqrt{3}$ b) $7\sqrt{3}$ c) $6\sqrt{7}$

3) a) $\sqrt{3}$ b) $-4\sqrt{5}$ c) $4\sqrt{6} - 5\sqrt{2}$ d) $-3\sqrt{10} + \sqrt{5}$

4) a) $4\sqrt{2}$ b) $-3\sqrt{5} - 6\sqrt{3}$ c) $14\sqrt{3} - 4\sqrt{2}$ d) $5\sqrt{11} + 5\sqrt{22}$

5) a) $30\sqrt{2}$ b) $40\sqrt{2}$ c) $55\sqrt{6}$

6) a) $24 - 3\sqrt{5}$ b) $3\sqrt{2} - 3$ c) $64 + 48\sqrt{6}$

7) a) $27 + 10\sqrt{2}$ b) $5\sqrt{3} + 5\sqrt{6} + 10\sqrt{2} + 20$ c) -4 d) $-17 + \sqrt{7}$

8) a) $-\frac{1}{2}\sqrt{6}$ b) $2\sqrt{2}$

9) a) $3\sqrt{2}$ b) $60\sqrt{2}$ c) 45 d) 2π

10) area = $12\sqrt{7}$ cm²; perimeter = $12 + 4\sqrt{7}$ cm

11) a) $3 - \sqrt{6}$ b) $3 - \sqrt{3}$

W5 - 1.5 Solving Quadratic Equations - Part 1: Solve by Factoring

MCR3U

Jensen

1) Solve by factoring

a) $x^2 + 8x + 12 = 0$

b) $h^2 + 9h + 18 = 0$

c) $m^2 + 3m = 0$

d) $w^2 - 18w + 56 = 0$

e) $x^2 - 2x = 0$

f) $c^2 - 17c + 30 = 0$

2) Solve

a) $3x^2 + 28x + 9 = 0$

b) $4k^2 + 19k + 15 = 0$

c) $16b^2 - 1 = 0$

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

3) Solve each quadratic equation by factoring

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

b) $x^2 + 3x - 10 = 0$

c) $4x^2 - 36 = 0$

d) $6x^2 - 14x + 8 = 0$

e) $15x^2 - 8x + 1 = 0$

f) $6x^2 + 19x + 10 = 0$

4) Solve by factoring

a) $-x^2 - 10x - 16 = 0$

b) $6d^2 + 15d = -9$

5) A rectangle has dimensions $x+10$ and $2x-3$. Determine the value of x that gives an area of 54 cm^2

Answers

1) a) -2, -6 b) -3, -6 c) 0, -3 d) 14, 4 e) 0, 2 f) 15, 2

2) a) $\frac{-1}{3}, -9$ b) $-1, \frac{-15}{4}$ c) $\frac{1}{4}, \frac{-1}{4}$ d) $\frac{3}{2}$

3) a) -3, 1 b) -5, 2 c) -3, 3 d) $\frac{4}{3}, 1$ e) $\frac{1}{5}, \frac{1}{3}$ f) $-\frac{5}{2}, -\frac{2}{3}$

4) a) -8, -2 b) $-1, \frac{-3}{2}$

5) 3.5

W6 - 1.5 Solving Quadratic Equations - Part 2: Solve Using the Q.F.

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Jensen



1) 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) $-2x^2 + 0.75x + 5 = 0$

2) Solve each quadratic using the quadratic formula. Give exact answers.

a) $x^2 + 4x - 3$

b) $-x^2 + 12 = 9x$

c) $x^2 = -5x + 2$

d) $x^2 - 3x + 1 = 6$

e) $x^2 + 6x + 9 = 0$

f) $4x^2 - 6x - 1 = 0$

g) $5x^2 - 3x - 1 = 0$

h) $-x^2 + 7x - 18 = 0$

i) $4x^2 - 25 = 0$

j) $3x^2 - 7x - 4 = x^2 - 4x$

k) $8x^2 + 4x - 5 = 0$

l) $4x^2 - 18x = 0$

3) Solve each quadratic equation using any method

a) $3x^2 - 12x = 0$

b) $2x^2 + 4x - 6 = 0$

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

d) $4x^2 - 11x - 8 = 0$

4) Three lengths of pipe measuring 24 cm, 31 cm, and 38 cm will be used to create a right triangle. The same length of pipe will be cut off each of the three pipes to allow a right triangle to be created. What is that length?

Answers

1) a) one b) one c) none d) two

2) a) $-2 + \sqrt{7}, -2 - \sqrt{7}$ b) $\frac{-9-\sqrt{129}}{2}, \frac{-9+\sqrt{129}}{2}$ c) $\frac{-5+\sqrt{33}}{2}, \frac{-5-\sqrt{33}}{2}$ d) $\frac{3+\sqrt{29}}{2}, \frac{3-\sqrt{29}}{2}$ e) -3 f) $\frac{3+\sqrt{13}}{4}, \frac{3-\sqrt{13}}{4}$

g) $\frac{3+\sqrt{29}}{10}, \frac{3-\sqrt{29}}{10}$ h) no roots i) $\frac{5}{2}, -\frac{5}{2}$ j) $\frac{3+\sqrt{41}}{4}, \frac{3-\sqrt{41}}{4}$ k) $\frac{-1+\sqrt{11}}{4}, \frac{-1-\sqrt{11}}{4}$ l) $\frac{9}{2}, 0$

3) a) $x = 0$ and $x = 4$ b) $x = 1$ and $x = -3$ c) $x = \frac{1}{3}$ and $x = -2$ d) $x = \frac{11 \pm \sqrt{249}}{8}$

4) 3 cm

W7 - 1.6 Determine a Quadratic Equation Given its Roots

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1) Find the equation of a quadratic function that has the given x-intercepts and contains the given point. Express each function in factored form.

a) -3 and 5, point (4, -3)

b) -4 and 7, point (-3, -12)

2) Express each function from #1 in standard form.

a)

b)

3) Find the equation of a quadratic function that has the given x-intercepts and contains the given point. Express each function in standard form.

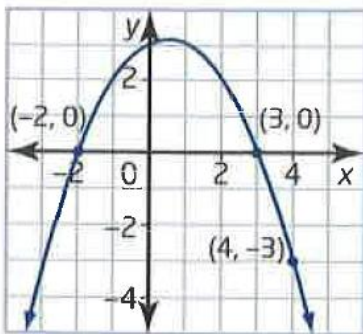
a) $1 \pm \sqrt{11}$, point (4, -6)

b) $-2 \pm \sqrt{7}$, point (1, 2)

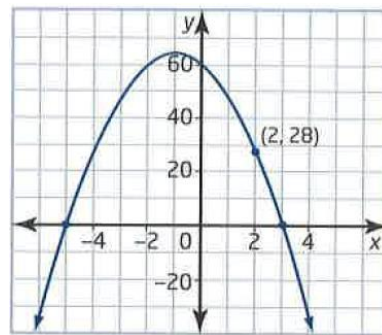
4) Find the equation of the quadratic function that has zeros at 3 and -1 and contains the point (1, -2). Express the function in vertex form.

5) Determine the equation in standard form for each quadratic function shown.

a)



b)



6) An arch of a highway overpass is in the shape of a parabola. The arch spans a distance of 12 meters from one side of the road to the other. The height of the arch is 8 meters at a horizontal distance of 2 meters from each side of the arch.

a) Sketch the quadratic function if the vertex of the parabola is on the y-axis and the road is along the x-axis.

b) Use this information to determine the function that models the arch.

c) Find the maximum height of the arch to the nearest tenth of a meter.

Answers

1) a) $f(x) = \frac{3}{7}(x + 3)(x - 5)$ **b)** $f(x) = \frac{6}{5}(x + 4)(x - 7)$

2) a) $f(x) = \frac{3}{7}x^2 - \frac{6}{7}x - \frac{45}{7}$ **b)** $f(x) = \frac{6}{5}x^2 - \frac{18}{5}x - \frac{168}{5}$

3) a) $f(x) = 3x^2 - 6x - 30$ **b)** $f(x) = x^2 + 4x - 3$

4) $f(x) = \frac{1}{2}(x - 1)^2 - 2$

5) a) $f(x) = -\frac{1}{2}x^2 + \frac{1}{2}x + 3$ **b)** $f(x) = -4x^2 - 8x + 60$

6) b) $f(x) = -\frac{2}{5}x^2 + \frac{72}{5}$ **c)** 14.4 m

W8 - 1.7 Solve Linear-Quadratic Systems

MCR3U

Jensen



1) Determine if each quadratic function will intersect once, twice, or not at all with the given linear function.

a) $y = 2x^2 - 2x + 1$ and $y = 3x - 5$

b) $y = -x^2 + 3x - 5$ and $y = -x - 1$

c) $y = \frac{1}{2}x^2 + 4x - 2$ and $y = x + 3$

d) $y = -\frac{2}{3}x^2 + x + 3$ and $y = x$

2) Determine the coordinates of the point(s) of intersection of each linear-quadratic system.

a) $y = x^2 - 7x + 15$ and $y = 2x - 5$

b) $y = 3x^2 - 16x + 37$ and $y = 8x + 1$

c) $y = \frac{1}{2}x^2 - 2x - 3$ and $y = -3x + 1$

3) Determine the value of the y-intercept of a line with the given slope that is a tangent line to the given curve.

a) $y = -2x^2 + 5x + 4$ and a line with a slope of 1

b) $y = -x^2 - 5x - 5$ and a line with a slope of -3

4) The path of an underground stream is given by the function $y = 4x^2 + 17x - 32$. Two new houses need wells to be dug. On the area plan, these houses lie on a line defined by the equation $y = -15x + 100$. Determine the coordinates where the two new wells should be dug.

Answers

1) **a)** do not intersect **b)** once **c)** twice **d)** twice

2) **a)** (4, 3), (5, 5) **b)** (2, 17), (6, 49) **c)** (-4, 13), (2, -5)

3) **a)** 6 **b)** -4

4) (-11, 265), (3, 55)