

Chapter Test

1. Solve by graphing. Check real solutions.

a) $x^2 + 2x - 8 = 0$ b) $x^2 - 9 = 0$ c) $x^2 - 4x + 4 = 0$
 d) $x^2 + 6x = 0$ e) $x^2 + 3 = -2x$ f) $-x^2 + 2x - 1 = 0$

2. Solve by factoring, and check.

a) $q^2 + 2q - 15 = 0$ b) $w^2 + 24 = 11w$ c) $2k^2 + 7k = 4$
 d) $9x^2 = 3x + 2$ e) $2x^2 = 3x$ f) $12x^2 - 3 = 0$
 g) $x^2 + 2x = -1$ h) $x^2 + 11 = 155$ i) $x^2 - \frac{3x}{2} + \frac{1}{2} = 0$

3. Sketch the graphs of the following quadratic functions by factoring to find the x -intercepts, and then deducing the coordinates of the vertex.

a) $y = x^2 + 6x + 5$ b) $y = x^2 + 4x - 5$

4. Solve using the quadratic formula.

a) $y^2 - 3y - 18 = 0$ b) $x^2 - 8x = -16$ c) $2x^2 + 8 + 8x = 0$
 d) $3x^2 - 17x = 0$ e) $9x^2 - 4 = 0$ f) $2x^2 + 2x = -1$
 g) $0 = 18w^2 + 9w - 2$ h) $12d^2 = 5d + 3$ i) $2 = -7p - 5p^2$

5. Solve using the quadratic formula. Express answers as exact roots and as approximate roots, to the nearest hundredth.

a) $x^2 + 5x - 7 = 0$ b) $0 = 4t^2 + 9t + 3$ c) $3x^2 - x = 7$

6. **Daily journal** The area of the front cover of a daily journal is 273 cm^2 , and the length is 8 cm greater than the width. What are the dimensions of the cover?

7. **Landscaping** A rectangular lawn measuring 8 m by 4 m is surrounded by a flower bed of uniform width. The combined area of the lawn and the flower bed is 165 m^2 . What is the width of the flower bed?

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1. a) $x = -4$ or $x = 2$ b) $x = \pm 3$ c) $x = 2$ d) $x = 0$ or $x = -6$ e) no real roots f) $x = 1$ 2. a) $q = -5$ or $q = 3$
 b) $w = 3$ or $w = 8$ c) $k = \frac{1}{2}$ or $k = -4$ d) $x = -\frac{1}{3}$ or $x = \frac{2}{3}$
 e) $x = 0$ or $x = \frac{3}{2}$ f) $x = \pm \frac{1}{2}$ g) $x = -1$ h) $x = \pm 12$ i) $x = \frac{1}{2}$ or $x = 1$ 3. a) x -intercepts: $-1, -5$; vertex $(-3, -4)$
 b) x -intercepts: $1, -5$; vertex $(-2, -9)$ 4. a) $y = 6$ or $y = -3$ b) $x = 4$ c) $x = -2$ d) $x = \frac{17}{3}$ or $x = 0$ e) $x = \pm \frac{2}{3}$
 f) no real roots g) $w = \frac{1}{6}$ or $w = -\frac{2}{3}$ h) $d = \frac{3}{4}$ or $d = -\frac{1}{3}$
 i) $p = -\frac{2}{5}$ or $p = -1$ 5. a) $x = \frac{-5 \pm \sqrt{53}}{2}$; $x = 1.14$ or $x = -6.14$ b) $t = \frac{-9 \pm \sqrt{33}}{8}$; $t = -0.41$ or $t = -1.84$
 c) $x = \frac{1 \pm \sqrt{85}}{6}$; $x = 1.70$ or $x = -1.37$ 6. $w = 13 \text{ cm}$, $l = 21 \text{ cm}$ 7. 3.5 m

MPM2D -

Homework

Solving Quadratic Equations: Application Problems

1. Bianca and Olivia determine that the expression $A = -2w^2 + 36w$ models the area of a rectangle, where w = width in metres and A = area in metres squared. What dimensions produce an area of 112m? (4m x 28m or 14m x 8m)

2. Fraser and Rowe jump out of an airplane 5.5km above the ground. The equation $h = 5500 - 5t^2$ is an approximate model for their altitude in metres at t seconds after jumping out of the plane.

a) After 10s how far have Fraser and Rowe fallen? (500m)

b) They open their chutes at an altitude of 1000m. How long did they free-fall? (30s)

c) If their parachutes do not open at 1000m, how much time is left to use the emergency chutes? (3s)

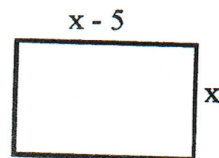
3. Luke shoots a model rocket from the roof of a school. The height at any time is approximated by the model $h = 15 + 23t - 5t^2$, where h = height in metres and t = time in seconds.

a) What is the height of the school? (15m)

b) How long does it take for the rocket to pass a window 10m above the ground? (4.8s)

c) When does the rocket hit the ground? (5.2s)

4. The area of the rectangle shown is 36m^2 . What are its dimensions? (9m x 4m)



5. A photograph measuring 12m by 8m is to be surrounded by a mat of uniform width. The area of the mat is equal to the area of the photograph. Find the width of the mat. (2m)

6. An area rug has a central 5m by 3m rectangle in a mosaic pattern, with a plain border of uniform width around it. The total area of the rug is 24m^2 . Find the width of the border. (0.5m)

7. Two numbers differ by 6. If the numbers are squared and then added, the result is 146. What are the numbers? (11, 5 or -11, -5)

8. Two consecutive integers are added. The square of their sum is 361. What are the integers? (9, 10 or -9, -10)

- 2D

Solving by Graphing

Practice

A

1. Solve by graphing. Check real solutions.

a) $x^2 + x - 6 = 0$

c) $x^2 - 4 = 0$

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

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

b) $x^2 - 5x + 4 = 0$

d) $x^2 + x + 1 = 0$

f) $x^2 + 3x - 4 = 0$

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

2. Solve by graphing.

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

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

e) $-x^2 - 1 = 0$

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

i) $x + 3 = -x^2$

b) $x^2 + 3x = 4$

d) $9 - x^2 = 0$

f) $x^2 = 5 - 4x$

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

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

SOLUTIONS

Practice 1. a) $x = -3$ or $x = 2$ b) $x = 1$ or $x = 4$
c) $x = 2$ or $x = -2$ d) no real roots e) $x = 2$ or $x = -1$
f) $x = -4$ or $x = 1$ g) $x = -3$ h) $x = 0$ or $x = 5$
2. a) $x = 0$ or $x = -3$ b) $x = -4$ or $x = 1$ c) $x = 0$ or
 $x = 3$ d) $x = 3$ or $x = -3$ e) no real roots f) $x = -5$ or
 $x = 1$ g) $x = 2$ or $x = -1$ h) $x = 1$ or $x = 2$ i) no real
roots j) $x = 2$

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1. a) $8y^2 - 3y - 3$ b) $-7x + 2$ 2. a) $10a^4b^5$ b) $5xz^2$
3. a) $-6m - 14$ b) $5x^2 - 11x$ c) $-4a^3 - 7a^2 + 4a$
4. a) $y^2 + 2y - 15$ b) $6x^2 - 7x + 2$ c) $2a^2 - 5ab - 3b^2$
5. a) $m^2 - 12m - 3$ b) $6x^2 + 2x + 19$ 6. a) $x^2 - 2x + 1$
- b) $4y^2 - 9$ c) $x^2 + 4xy + 4y^2$ d) $30x^2 + 12x - 1$
7. a) $4m(m - 7)$ b) $3ab(1 - 3b + 2a)$ c) $(m - 2)(x - 4)$
- d) $(y + 2)(y + x)$ 8. a) $(x - 4)(x - 3)$ b) $(a + 7)(a - 3)$
- c) $(y + 4)(y + 5)$ d) $(t - 9)(t + 3)$ e) $(x + 5y)(x + y)$
- f) $(m - 2n)(m - 7n)$ 9. a) $3(x - 2)(x + 1)$
- b) $4(t - 2)(t - 5)$ c) $a(y + 4)(y - 3)$

10. a) $(t + 1)(3t + 5)$ b) $(m - 4)(2m - 1)$
- c) $(3x - 2)(2x + 1)$ d) $(2y - 1)(2y + 3)$ e) $(r - 2s)(5r - s)$
- f) $(2x - 5y)(2x + y)$ 11. a) $(x + 2)(x - 2)$
- b) $(1 + 6m)(1 - 6m)$ c) $(6t + 7s)(6t - 7s)$
- d) $(11a + b)(11a - b)$ e) $(x + 4)^2$ f) $(y - 3)^2$ g) $(2t - 1)^2$
- h) $(2m + 5)^2$ 12. a) $3(y + 3)(y - 3)$ b) $t(3 + 2t)(3 - 2t)$
- c) $2(2x + 3)^2$ d) $x(x - 2)^2$

13. a) $(5x + 3)^2 = 25x^2 + 30x + 9$ b) 1444 cm^2
14. a) $(5x - 8)(2x + 5)$ b) $152 \text{ mm by } 69 \text{ mm}$

Chapter Test

1. Simplify.

a) $(3y^2 - 2y + 1) + (5y^2 - y - 4)$

b) $(2x^2 - 3x - 5) - (2x^2 + 4x - 7)$

2. Simplify.

a) $(-2ab^2)(-5a^3b^3)$

b) $\frac{-45x^3yz^2}{-9x^2y}$

3. Expand and simplify.

a) $2(m - 5) - 4(2m + 1)$

b) $4x(2x - 3) - x(3x - 1)$

c) $2a(a^2 - 2a - 1) - 3a(2a^2 + a - 2)$

4. Find the product.

a) $(y - 3)(y + 5)$

b) $(3x - 2)(2x - 1)$

c) $(2a + b)(a - 3b)$

5. Expand and simplify.

a) $(3m + 2)(m - 3) - (2m - 1)(m + 3)$

b) $2(3x + 1)(x + 2) - 3(4x - 5)$

6. Expand and simplify.

a) $(x - 1)^2$ $(x - 1)(x + 1)$

b) $(2y - 3)(2y + 3)$

c) $(x + 2y)^2$

d) $2(3x + 1)^2 + 3(2x - 1)(2x + 1)$

7. Factor.

a) $4m^2 - 28m$

b) $3ab - 9ab^2 + 6a^2b$

c) $x(m - 2) - 4(m - 2)$

d) $y^2 + 2x + 2y + xy$

8. Factor.

a) $x^2 - 7x + 12$

b) $a^2 + 4a - 21$

c) $y^2 + 9y + 20$

d) $t^2 - 6t - 27$

e) $x^2 + 6xy + 5y^2$

f) $m^2 - 9mn + 14n^2$

9. Factor fully.

a) $3x^2 - 3x - 6$

b) $4t^2 - 28t + 40$

c) $ay^2 + ay - 12a$

10. Factor.

a) $3t^2 + 8t + 5$

b) $2m^2 - 9m + 4$

c) $6x^2 - x - 2$

d) $4y^2 + 4y - 3$

e) $5r^2 - 11rs + 2s^2$

f) $4x^2 - 8xy - 5y^2$

11. Factor.

a) $x^2 - 4$

b) $1 - 36m^2$

c) $36t^2 - 49s^2$

d) $121a^2 - b^2$

e) $x^2 + 8x + 16$

f) $y^2 - 6y + 9$

g) $4t^2 - 4t + 1$

h) $4m^2 + 20m + 25$

12. Factor fully.

a) $3y^2 - 27$

b) $9t - 4t^3$

c) $8x^2 + 24x + 18$

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

2D -

#1, 2, 4, 6-8, 10-12

REVIEW:

QUADRATICS

1. a) not a function **b)** function **c)** function **2. a)** up; (0, -1); $x = 0$; domain: set of real numbers, range: $y \geq -1$; minimum: -1 **b)** down; (0, 5); $x = 0$; domain: set of real numbers, range: $y \leq 5$; maximum: 5
3. a) none **b)** ± 3.2 **c)** ± 1.6 **4. a)** up; not stretched or shrunk; (-3, -1); $x = -3$; domain: set of real numbers, range: $y \geq -1$; minimum: -1 **b)** down; vertically stretched by a factor of 2; (5, -2); $x = 5$; domain: set of real numbers, range: $y \leq -2$; maximum: -2
c) down; vertically shrunk by a factor of 0.5; (-2, 3); $x = -2$; domain: set of real numbers, range: $y \leq 3$; maximum: 3 **5. a)** -4.1, 0.1 **b)** 0.3, 3.7

SOLUTIONS

6. a) $y = (x+4)^2 - 8$; (-4, -8); $x = -4$; Points may vary. (0, 8), (-1, 1) **b)** $y = -(x+5)^2 + 21$; (-5, 21); $x = -5$; Points may vary. (0, -4), (-1, 5) **7. a)** (5, -25); $x = 5$; x -intercepts: 0, 10; y -intercept: 0; $y \geq -25$
b) (-3, -1); $x = -3$; x -intercepts: none; y -intercept: -10; $y \leq -1$ **8. a)** (-3, -5) **b)** (4, -2)
9. a) $y = x(x-8) + 5$; points: (0, 5), (8, 5)
b) $y = -2x(x-2) - 3$; points: (0, -3), (2, -3)
10. a) quadratic **b)** linear **c)** neither **11. a)** 86 m
b) 2 m **c)** 8 s **12. a)** $A = w^2 + 2w$ **b)** 675
14. a) $y = x^2 - 2$; $y = x^2 - 2$ **b)** $y = -x^2 + 3$; $y = -x^2 + 0.3x + 3$

1. State whether each set of ordered pairs represents a function.

a) $\{(2, 4), (3, 5), (7, 9), (2, -5), (3, -7)\}$

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

c) $\{(-1, 6), (0, -6), (1, -6), (2, -6)\}$

2. Sketch the graph of each parabola and state the direction of the opening, the coordinates of the vertex, the equation of the axis of symmetry, the domain and range, and the maximum or minimum value.

a) $y = x^2 - 1$

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

3. Use a graphing calculator or graphing software to determine any x -intercepts, to the nearest tenth.

a) $y = x^2 + 3$

b) $y = -x^2 + 10$

c) $y = 8 - 3x^2$

4. Without sketching each parabola, state the direction of the opening, how the parabola is stretched or shrunk, if at all, the coordinates of the vertex, the equation of the axis of symmetry, the domain and range, and the maximum or minimum value.

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

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

c) $y = -0.5(x+2)^2 + 3$

5. Use a graphing calculator or graphing software to determine any x -intercepts, to the nearest tenth.

a) $y = 2(x+2)^2 - 9$

b) $y = -(x-2)^2 + 3$

6. Write each function in the form $y = a(x-h)^2 + k$. Sketch the graph, showing the coordinates of the vertex, the equation of the axis of symmetry, and the coordinates of two other points on the graph.

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

b) $y = -x^2 - 10x - 4$

7. Sketch the graph of each function. Show the coordinates of the vertex, the equation of the axis of symmetry, and any intercepts. State the range.

a) $y = x^2 - 10x$

b) $y = -x^2 - 6x - 10$

8. Find the coordinates of the vertex.

a) $y = 2x^2 + 12x + 13$

b) $y = -3x^2 + 24x - 50$

9. Sketch the graph of each of the following quadratic functions by writing it in the form $y = ax(x-s) + t$.

a) $y = x^2 - 8x + 5$

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

10. Use finite differences to determine whether each function is linear, quadratic, or neither.

a)	x	y
	0	-1
	1	1
	2	7
	3	17

b)	x	y
	2	0
	4	4
	6	8
	8	12

c)	x	y
	1	1
	2	16
	3	81
	4	256

11. Flare The height, h metres, of a flare as a function of the time, t seconds, since the flare was fired from a boat, can be modelled by the function

$$h = -5.25(t-4)^2 + 86$$

a) What was the maximum height of the flare?

b) What was its height when it was fired?

c) How many seconds after it was fired did the flare hit the water, to the nearest second?

12. Riverboat cruise The captain of a riverboat cruise charges \$36 per person, including lunch. The cruise averages 300 customers a day. The captain is considering increasing the price. A survey of customers indicates that for every \$2 increase, there would be 10 fewer customers. What increase in price would maximize the revenue?

1. The CD Shack is selling the latest release from the group 'The Quadratics'. Research shows them that they can sell 300 CDs per day at \$12.00 each. For every 25 cent increase in price, they will lose 5 sales per day. Determine the price that will generate the maximum revenue. **(\$13.50)**
2. Farmer Fred wishes to enclose a rectangular pen. Fred has 900m of fencing. Find the dimensions of the pen that will create the largest area. **(225m X 225m)**
3. Farmer Fred changes his mind and wants to have his barn serve as one side of the pen. This means that the 900m of fence is used for the other three sides of the pen. Find the dimensions that create the maximum area. **(450mX225m)**
4. A person throws a ball off of a cliff. If the ball's height, in metres, is given by $h = -4.9t^2 + 9.8t + 30$, t in seconds,
 - a. Determine the initial height of the ball. **(30m)**
 - b. What is the maximum height? **(34.9m)**
 - c. How long after being thrown does the ball reach its maximum height? **(1s)**

- 1** A function is a set of ordered pairs in which, for every x , there is only one y .
- 2** If any vertical line passes through more than one point on the graph of a relation, then the relation is not a function.
- 3** The set of the first elements in a relation is called the domain. The set of the second elements in a relation is called the range.

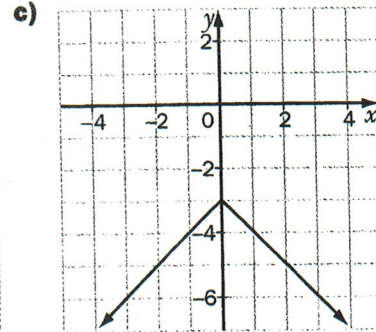
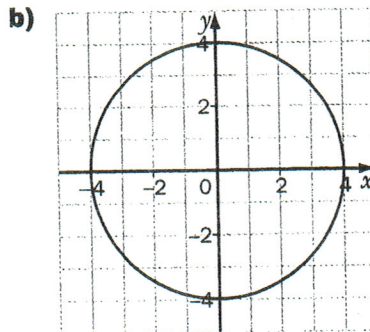
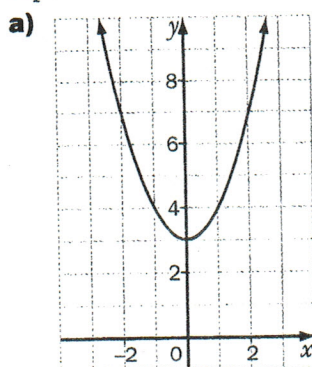
Communicate Your Understanding

1. Explain the difference between a relation and a function.
2. Describe how you would determine which of the following relations is a function.

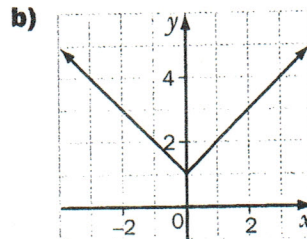
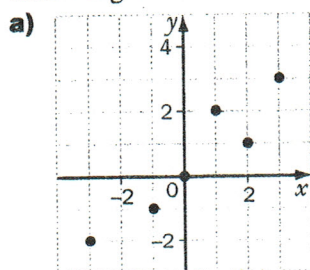
a)	x	y	b)	x	y
	2	4		7	6
	1	2		5	3
	0	1		5	4
	-1	2		3	1
	-2	5		1	0

c) $\{(1, 3), (2, 4), (4, 9), (3, 7), (2, 6)\}$

3. Describe how you would determine which of the following graphs represent functions.



4. Describe how you would determine the domain and range of each of the following functions.



9. State the domain and range of each relation, and state whether it is a function.

a)	x	y	b)	x	y
	2	5		3	1
	1	2		3	-2
	0	1		2	0
	-1	2		1	-1
	-2	5		0	-2

11. The function $y = x^2 + 2$ has a domain $\{-2, -1, 0, 1, 2\}$. Find the range.

9. a) domain: $\{-2, -1, 0, 1, 2\}$, range: $\{1, 2, 5\}$;
function b) domain: $\{0, 1, 2, 3\}$, range: $\{-2, -1, 0, 1\}$;
not a function

11. $\{2, 3, 6\}$

Solutions