AChor/MBF3C **Name: _____**
Date: _____

Practice Test 4: Quadratic Relations

K: _____	A: _____	T: _____	C: _____

PART A: Multiple Choice Questions
Instructions: Circle the English letter of the best answer.
Circle one and ONLY one answer for each question.

Knowledge/Thinking:

1. Which of these relations is quadratic?

(a) $y = 0.5x - 7$ (b) $y = 5.8x + 3x^2 - 9$ (c) $y = 2x^2 + 4x^3$ (d) $3x + 2y = 10$ (e) $y = 2^x$

2. Which parabola has its vertex 3 units above the *x*-axis?

(a) $y = 3(x-5)^2 + 4$ (b) $y = 5(x+4)^2 - 3$ (c) $y = -(x-7)^2 + 3$ (d) $y = 0.3(x+3)^2 - 10$

3. Which parabola has its vertex farthest from the *y*-axis?

(a) $y = 20(x-5)^2 + 6$ (b) $y = 4(x+2)^2 - 17$ (c) $y = 0.5(x-0.8)^2 + 9$ (d) $y = 0.1(x-15)^2 + 3$

4. Which parabola is the most vertically stretched?

(a) $y = -5(x+4)^2 - 3$ (b) $y = 0.5(x-0.8)^2 + 9$ (c) $y = -0.1(x-15)^2 + 3$ (d) $y = 3(x-5)^2 + 4$

5. The parabola represented by the relation $y = -8(x+15)^2 + 12$ has which vertex?

(a) (–8, 15) (b) (–15, –12) (c) (15, 12) (d) (12, –15) (e) (–15, 12)

6. Which relation in standard form represents the same parabola as $y = 5(x-6)^2 - 20$?

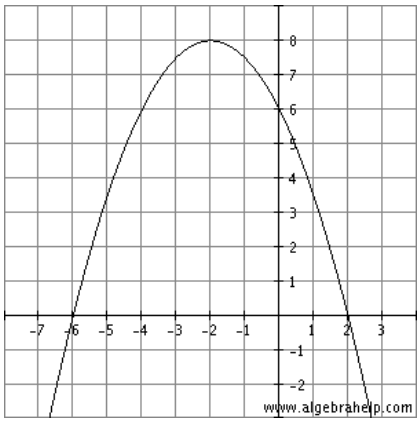
(a) $y = 5x^2 - 6x - 20$ (b) $y = 5x^2 - 12x + 16$ (c) $y = 5x^2 - 60x + 160$ (d) $y = 5x^2 - 12x + 160$

7. Which are the zeros for the quadratic relation $y = 4x^2 - 100$?

(a) $x = 0$ (b) $x = 2$ and 10 (c) $x = 5$ and 10 (d) $x = -5$ and 5 (e) $x = 4$ and 5

8. Which is the equation for the parabola shown on the right?

(a) $y = -0.5(x-2)^2 + 8$
(b) $y = -0.5(x+8)^2 - 2$
(c) $y = -0.5(x+2)^2 + 8$
(d) $y = 2(x-2)^2 + 8$
(e) $y = -2(x+2)^2 + 8$



Part B: Full Solution Questions

Instructions: Show all steps for full mark.
Provide answer statements in complete English sentences where applicable.

Knowledge:

1. For each of the following relations, use finite differences to determine if the relation is linear, quadratic or neither. **Explain your reasoning.** [K: 8]

(a)

x	***y***
1	2
2	–4
3	–10
4	–16

(b)

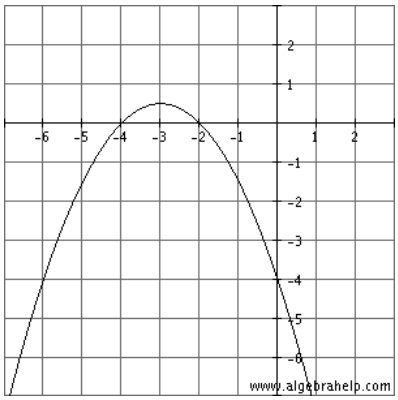
x	***y***
2	50
4	32
6	18
8	8

2. For each of the following quadratic relations,
(a) state the coordinates of the vertex.
(b) state the direction of opening.
(c) state the equation for the axis of symmetry.

(i) $y = 3(x-5)^2 - 8$ [K: 3]

(ii) $y = -\frac{1}{4}(x+2)^2 + 7$ [K: 3]

3. State the *x*- and *y*-intercepts of each quadratic relation. [K: 3]



4. Each relation is in vertex form. Write each relation in standard form, and in intercept form.

(a) $y = 2(x+1)^2 - 18$ [K: 6]

(b) $y = -0.5(x+8)^2 + 18$ [K: 6]

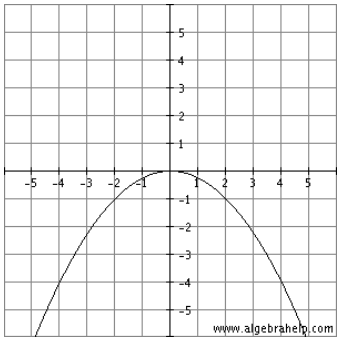
5. Find the *x*-intercept and *y*-intercept of each relation.

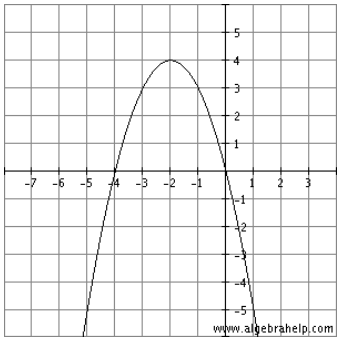
(a) $y = 4(x-8)^2 - 16$ [K: 6]

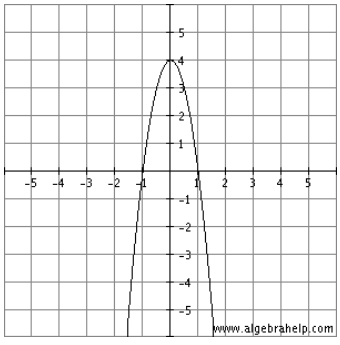
(b) $y = 3x^2 - 33x - 36$ [K: 3]

6. Match the following graphs to their corresponding equations. Choose only three. [K: 3]

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



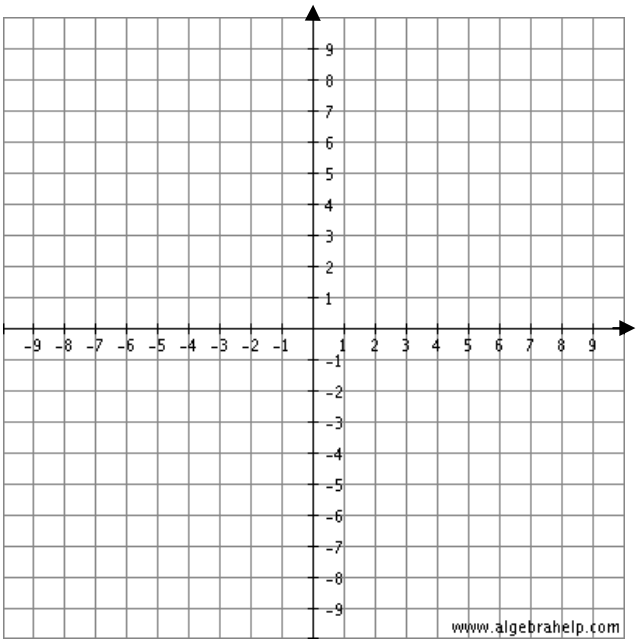




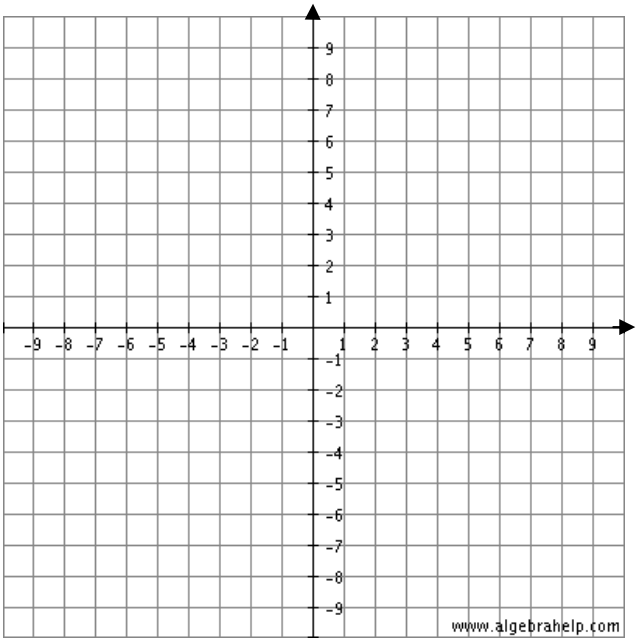
Communication:

7. For each quadratic relation,
(a) describe the transformation of the parabola as compared to the graph of $y = x^2$.
(b) sketch the graph of the parabola.

(i) $y = \frac{1}{2}(x-4)^2 - 6$ [C: 8]



(ii) $y = -3(x+5)^2 + 9$ [C: 8]



8. Explain whether each relation has more than one zero, only one zero, or no zero. [C: 4]

(a) $y = -8x^2 + 14$

(b) $y = -(x + 6)^2$

Application:

9. A football player kicks a ball into the air. The ball's path can be modelled by the relation $h = -0.04(d - 19)^2 + 14.44$, where h is the ball's height, and d is the ball's distance from the kicker, both in metres.

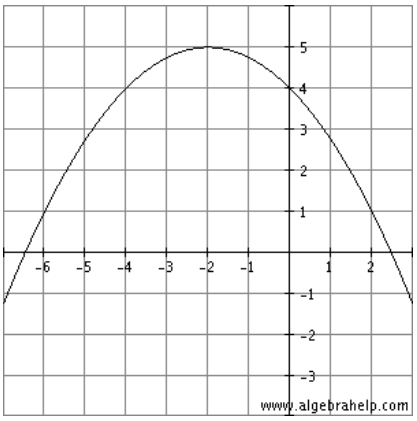
(a) What is the maximum height reached by the ball? What is the ball's horizontal distance at this point? [A: 2]

(b) What horizontal distance will the ball travel before it lands? [A: 4]

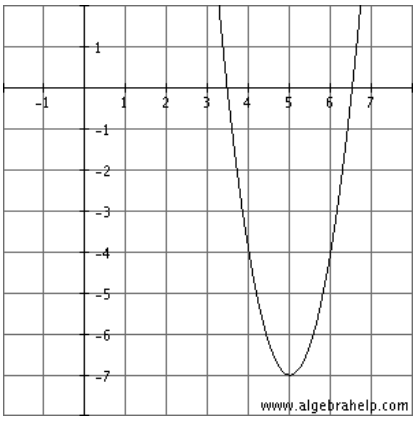
(c) The goalposts are 35 m away from the kicker and the crossbar across the goalposts is about 3 m high. Will the ball clear the crossbar? Explain. [A: 3]

10. For each of the following parabolas, state the equation for the quadratic relation in the form $y = a(x-h)^2 + k$. [A: 8]

(a)



(b)



Thinking:

11. A parabola, whose vertex is (3, –5), opens upward and passes through point (13, 20). Determine its equation in the form $y = a(x-h)^2 + k$. [T: 4]

12. A soccer ball is kicked from the ground level. When it has travelled 35 m horizontally, it reaches its maximum height of 25 m. The soccer ball lands on the ground 70 m from where it was kicked. Model this situation with a relation in the form $y = a(x-h)^2 + k$. [T: 4]

13. Examine the given table of values and determine the equation of the relation in the form $y = a(x-h)^2 + k$. [T: 4]

x	***y***
–1	–32
0	–18
1	–8
2	–2
3	0
4	–2

Answers:

Part A:
1. b; **2.** c; **3.** d; **4.** a; **5.** e; **6.** c; **7.** d; **8.** c

Part B:
1. (a) linear since first differences are constant**, (b)** quadratic since second differences are constant;
2. (i) (a) (5, –8), **(b)** upward, **(c)** $x = 5$, **(ii) (a)** (–2, 7), **(b)** downward, **(c)** $x = -2$;
3. *x*-intercepts = –4 and –2, *y*-intercept = –4;
4. (a) $y = 2x^2 + 4x - 16$, $y = 2(x-2)(x+4)$, **(b)** $y = -0.5x^2 - 8x - 14$, $y = -0.5(x+2)(x+14)$;
5. (a) *x*-intercepts = 6 and 10, *y*-intercept = 240, **(b)** *x*-intercepts = –1 and 12, *y*-intercept = –36
6. $y = -\frac{1}{4}x^2$, $y = -(x+2)^2 + 4$, $y = -4x^2 + 4$;
7. (a) The parabola is a vertical compression of $y = x^2$ by a factor of 2, and it is vertically translated downward by 6 units and horizontally translated to the right by 4 units relative to $y = x^2$,
(b) The parabola is a vertical stretch of $y = x^2$ by a factor of 3, reflected in the *x*-axis, and it is vertically translated upward by 9 units and horizontally translated to the left by 5 units relative to $y = x^2$;
8. (a) two zeros because the parabola opens downward with the vertex above the *x*-axis, intersecting with the *x*-axis twice, **(b)** one zero because the parabola has its vertex on the *x*-axis;
9. (a) 14.44 m when horizontal distance is 19 m, **(b)** 38 m, **(c)** yes, height of ball is 4.2 m when the ball is 35 m away and it is higher than the 3-m crossbar;
10. (a) $y = -\frac{1}{4}(x+2)^2 + 5$, **(b)** $y = 3(x-5)^2 - 7$; **11.** $y = -0.25(x-3)^2 - 5$; **12.** $y = -0.02(x-35)^2 + 25$;
13. $y = -2(x-3)^2$