# MPM 2DI EXAM REVIEW – Chapter 4: Quadratic Relations

- **WHERE IS YOUR GRAPH PAPER? FIND IT!**
- **YOU ALSO REQUIRE A TEXTBOOK TO COMPLETE THE LAST SEVERAL QUESTIONS.**

1. The path of a rocket fired at a Canada Day fireworks display is given by $h = -4.9t^2 + 19.6t + 0.4$, where h is the height, in metres, of the rocket above the ground and t is the time, in seconds.
   a) Make a **table of values** for $t = 0$ to $t = 4$.
   b) Make a table of first and second differences. What conclusion can you make?
   c) Draw the graph of the path of the rocket. Describe the path of the rocket.
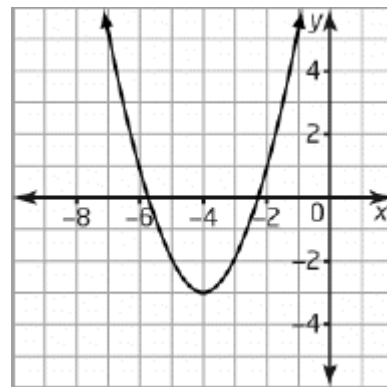   d) How high above the ground was the rocket when it was set off?

For the rest of this review booklet, quadratic relations <u>CANNOT</u> be graphed using a table of values.

2. What is the equation of the new parabola if the graph of $y = x^2$ is translated 7 units to the right?
3. What is the equation of the new parabola if the graph of $y = x^2$ is translated 3 units to the left?
4. What is the equation of the new parabola if the graph of $y = x^2$ is translated 6 units to the left and 3 units down?
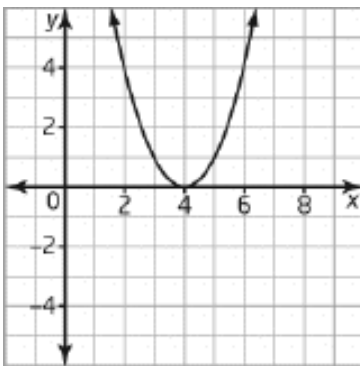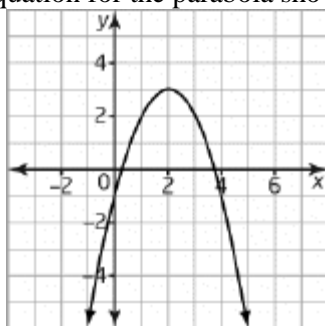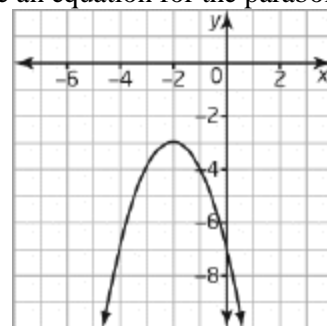
| 5. Write an equation for the parabola shown.	6. Write an equation for the parabola shown.
7. Write an equation for the parabola shown.	8.　　　Write an equation for the parabola shown.

9. Write an equation for a parabola that is congruent to the graph of $y = x^2$, opens downward, and has its vertex at $(-3, 1)$.

10. Graph the relation $y = -x^2 + 9$. Label at least 5 ordered pairs on the graph.

11. Graph the relation $y = -2(x + 6)^2 + 8$. Label at least 5 ordered pairs on the graph.

12. Graph the relation $y = -\frac{1}{8}(x + 4)^2 + 6$. Label at least 5 ordered pairs on the graph.

13. Kim is drafting the windows for a new building. Their shape can be modelled by the relation $h = -w^2 + 4$, where h is the height and w is the width of points on the window frame, measured in metres.
    a) Graph the relation.
    b) Find the maximum height of each window.　　　c) Find the width of each window at its base.

14. For the quadratic relation $y = -3(x-4)^2 + 5$, state the following:
   a) the direction of opening
   b) the stretch or compression factor
   c) the coordinates of the vertex
   d) the equation of the axis of symmetry
   e) the maximum or minimum value of y

15. A football quarterback passes the ball to a receiver 40 m down-field. The path of the ball can be described by the relation $h = -0.01(d - 20)^2 + 6$, where h is the height of the ball, in metres, and d is the horizontal distance of the ball from the quarterback, in metres.
   a) What is the maximum height of the ball?
   b) What is the horizontal distance of the ball from the quarterback at its maximum height?
   c) What was the height of the ball when it was thrown?
   d) What was the height of the ball when it was caught?
   e) If a defensive back is 2 m in front of the receiver, how far is he from the quarterback?
   f) How high would the defensive back have to reach to knock down the pass?

16. Determine the equation of this parabola:
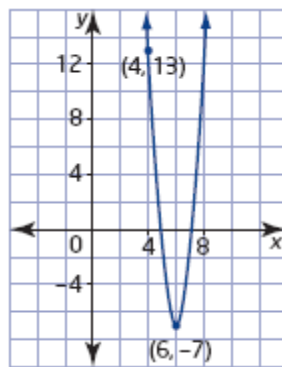
17. Graph the relation $y = -2(x-2)(x-6)$. Label at least 5 ordered pairs on the graph.

18. The path of a golf ball is described by the relation $h = -0.005x(x-150)$ where h is the height of the ball (metres) and x is the horizontal distance travelled (metres).
   a) What is the height of the ball when it is originally struck? Explain.
   b) After how many metres horizontally does the ball reach its maximum height? What is its maximum height? Explain.

19.   Textbook Page 203 #8

20.   Textbook Page 203 #9

21.   Textbook Page 203 #10

22.   Textbook Page 204 #4

FINAL ANSWERS

1. a) and b)

T	h	First Differences	Second Differences
0	0.4		
1	15.1	14.7	
2	20	4.9	−9.8
3	15.1	−4.9	−9.8
4	0.4	−14.7	−9.8

The second differences are constant, so the relation is quadratic.

c) * Your graph must match this EXACTLY

CAREFUL!
The h-intercept
is 0.4

The rocket rises for approximately 2 s, and then falls to the ground in approximately 2 s.

d) The rocket was 0.4 m off the ground at the beginning.

2. $y = (x-7)^2$

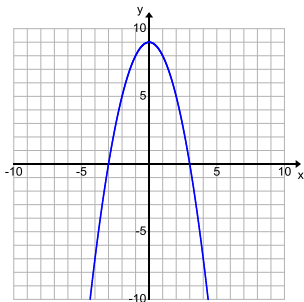3. $y = (x+3)^2$

4. $y = (x+6)^2 - 3$

5. $y = (x-4)^2$

6. $y = (x+4)^2 - 3$

7. $y = -(x-2)^2 + 3$ * don't confuse this with the next question

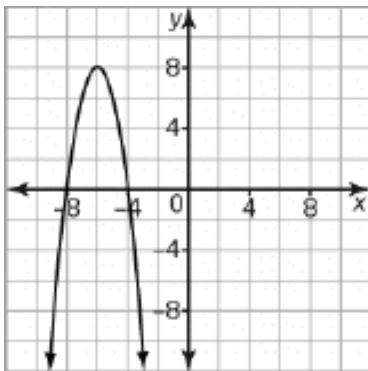8. $y = -(x+2)^2 - 3$ * don't confuse this with the previous question
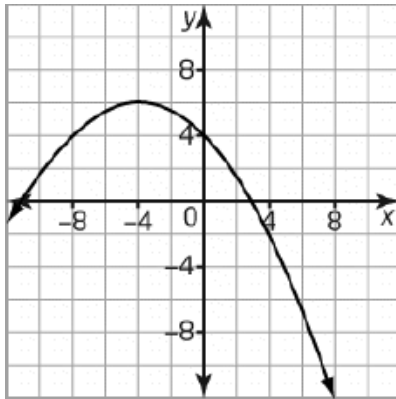
9. $y = -(x+3)^2 + 1$

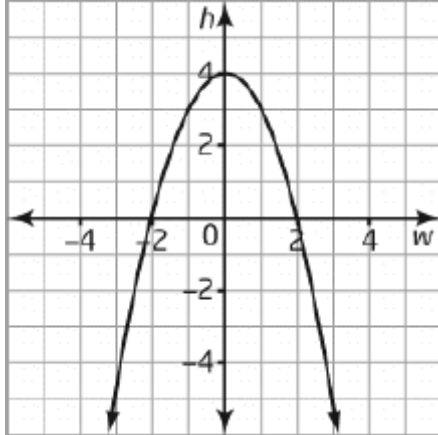10.

* Your graph must match this EXACTLY

11.

* Your graph must match this EXACTLY (although you may have used a different scale)

12.

* Your graph must match this EXACTLY (although you may have used a different scale)

13 a) * Your graph must match this EXACTLY

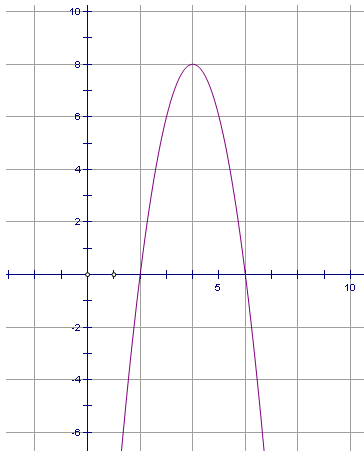b) The maximum height of each window is 4 m.

c) The base of the window is the distance from the points $(-2, 0)$ and $(2, 0)$. The width of each window at its base is 4 m.

14.
a) downward
b) stretch by a factor of 3
c) $(4, 5)$
d) $x = 4$
e) maximum value of 5

15.
a) 6 m
b) 20 m
c) 2 m
d) 2 m
e) 38 m
f) 2.76 m

16. $y = 5(x - 6)^2 - 7$

17.

18. a) Let $x = 0$. Hence, $h = 0$. Thus the ball was 0 m off the ground when struck.
   b) The zeroes are $x = 0$ and $x = 150$. Hence, the axis of symmetry is $x = 75$. Therefore the vertex is (75, 28.125). The ball reaches a maximum height of 28.125 m when it has travelled 75 m horizontally.

19 to 22.   See the Textbook Final Answer Section