MPM 2DI EXAM REVIEW – Chapter 6: Quadratic Equations

Recall: Three forms of a **quadratic relation**:

$y = a(x - h)^2 + k$	$y = ax^2 + bx + c$	$y = a(x - r)(x - s)$
Vertex Form	**Standard Form**	**Zeroes Form**

Recall: A **quadratic equation** is of the form $0 = ax^2 + bx + c$, where $a \neq 0$

Recall: The **quadratic formula*** is used to find the roots/zeroes (if they exist) of quadratic equations.

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

* only apply the quadratic formula once factoring has been attempted to find the roots/zeroes

1. Determine the coordinates of the vertex for the relation $y = x^2 + 6x + 4$ by **first completing the square** and writing the equation in the form $y = a(x-h)^2 + k$.

2. **GRAPH PAPER REQUIRED.** Graph $y = 2x^2 + 12x + 10$ **by first completing the square** and writing the equation in the form $y = a(x-h)^2 + k$. Be sure to clearly indicate the vertex and label four other points on the parabola.

3. Find the maximum or minimum for the relation $y = -4x^2 + 24x - 13$ **by completing the square** and state the value for which the maximum or minimum occurs. Finally, state the axis of symmetry.

4. Solve by **factoring** (this means you may not use the Quadratic Formula)
   a) $x^2 + x - 6 = 0$ b) $3p^2 + 15p = 0$ c) $10x^2 + 21x - 10 = 0$ d) $10x^2 + 11x - 6 = 0$

5. Solve the following using the **quadratic formula**. Round to the nearest hundredth for part a) only.
   a) $2x^2 + 9x + 3 = 0$ b) $4x^2 - 12x + 9 = 0$

6. Solve $(3x - 4)^2 = (x + 5)(x - 3)$

7. The height (h) metres of a basketball based on horizontal distance (d) metres, from the player can be modeled by the relation $h = -0.09d^2 + 0.9d + 2$.
   a) What is the maximum height of the basketball? *(Hint: complete the square, to find the vertex)*
   b) What is the horizontal distance of the basketball when it is at maximum height?
   c) At what horizontal distance is the ball 3 m high? Round to the nearest tenth.

The remaining questions must be answered by determining a quadratic model, then solving it.

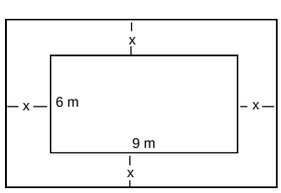
8. Two integers differ by 31. The sum of the squares of the integers is 485. Find the integers.

9. The area of a triangle is $18\ cm^2$, and the height is $3\ cm$ greater than the base. Find the length of the base, to the nearest hundredth of a centimetre.

10. The length of a rectangular flower garden is 2 metres more than twice the width. The area of the flower bed is $6\ m^2$. Find the **exact** dimensions of the flower bed.

11. Last fall the SAC sold 80 HHSS sweatshirts for $40 each. A survey shows that for every $2 decrease in price they will sell 5 more sweatshirts. What should the price per sweatshirt be to maximize the revenue?

12. The municipal Parks Department is planning a new flower bed outside city hall. It will be rectangular with dimensions 9 m by 6 m (as shown in the diagram). The flower bed will be surrounded by a path of constant width (x metres) with the *same area as the flower bed*. Find x.

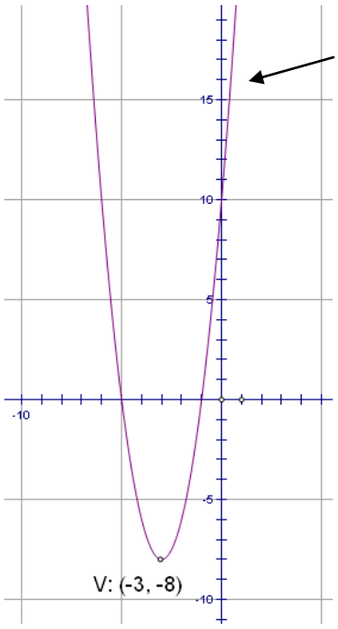


FINAL ANSWERS

1. $y = (x+3)^2 - 5$; vertex $(-3,-5)$
2. $y = 2(x+3)^2 - 8$
3. $y = -4(x-3)^2 + 23$
   A **maximum** of $y = 23$
   when $x = 3$.
   The axis of symmetry is
   $x = 3$.

4. a) $x = 2$ or $x = -3$
   b) $p = 0$ or $p = -5$
   c) $x = \frac{2}{5}$ or $x = \frac{-5}{2}$
   d) $x = \frac{2}{5}$ or $x = \frac{-3}{2}$

5. a) $x \approx -0.36$ or $x \approx -4.14$
   b) $x = \frac{3}{2}$



Graph for Question 2
$y = 2(x+3)^2 - 8$

6. Since $b^2 - 4ac < 0$ there are no real roots (i.e. no solution for x)

7. a) Completing the square gives $h = -0.09(d-5)^2 + 4.25$. Hence the maximum height is 4.25 m
   b) 5 metres
   c) Let $h = 3$ and solve for d. When the ball is 3 m in the air the ball is at $d \approx 8.7$ m and $d \approx 1.3$ m

8. The integers are -14 and 17 OR -17 and 14

9. The base is about 4.67 cm.

10. The dimensions: width = $\frac{-1+\sqrt{13}}{2}$ metres, length = $1+\sqrt{13}$ metres

11. Let x be the number of price decreases, and let R be the revenue. Hence $R = (40-2x)(80+5x)$
    … The price should be set at $36 each to get a maximum revenue of $3240.

12. For the area of the path to match the area of the garden, $x = 1.5$ m.