

| Expectation | Content | Comm | Total |
|--|---|------|-------|
| Q1/2: Determine the basic properties of quadratic relations. Relate transformations of the graph of $y = x^2$ to the algebraic representation of vertex form. | /38 | /4 | /42 |
| Vertex Form $y = a(x - h)^2 + k$ | Factored Form $y = a(x - r)(x - s)$ | | |

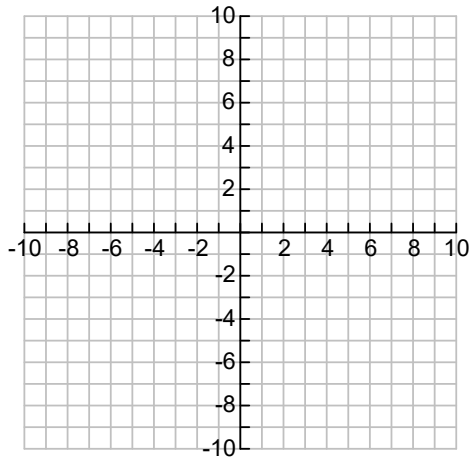
MPM2D Unit 3 Test: Quadratic Relations

April 15, 2026

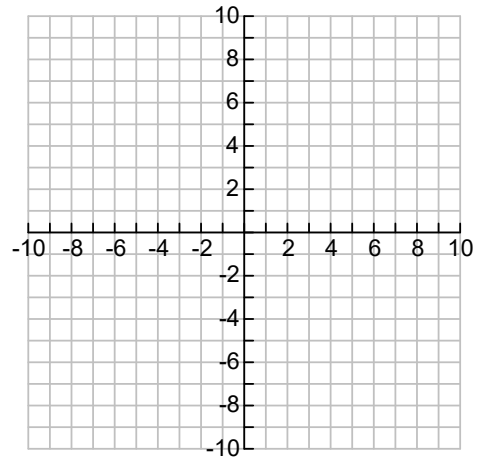
Name: _____

1. Graph each of the quadratic relations given below, including at least **5 exact points**. [4]

a) $y = (x - 3)^2 - 6$

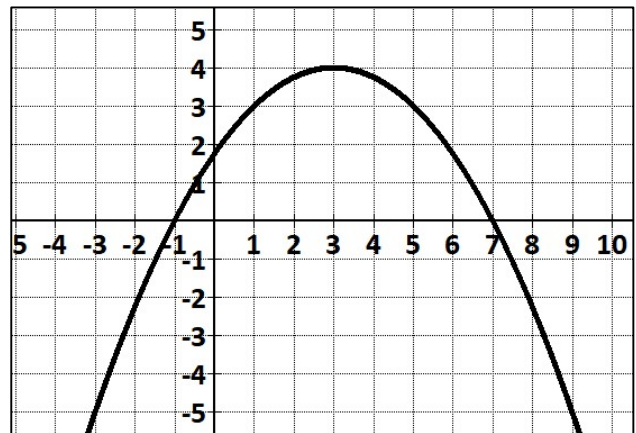


b) $y = -3(x + 2)^2 + 7$



2. For the given graph, fill in each blank. [4]

- a) The vertex is _____.
- b) The axis of symmetry is _____.
- c) The zeros are _____.
- d) There is a minimum/maximum (**circle your choice**) and its value is _____.
- e) The equation in **vertex form** (**do not solve algebraically**):



3. Calculate 1st and 2nd differences to determine if the relation is linear, quadratic or neither. [2]

| x | y | 1 st Diff | 2 nd Diff |
|----|-----|----------------------|----------------------|
| -2 | -1 | | |
| -1 | 1 | | |
| 0 | -2 | | |
| 1 | -10 | | |

4. A volleyball's height, h , in metres above the ground after t seconds, is modelled by the relation

$$h = -4.9(t - 0.5)^2 + 3.3.$$

[3]

a) What is the volleyball's height at the instant it is hit?

b) What is the maximum height the volleyball reaches?

c) When does the volleyball reach its maximum height?

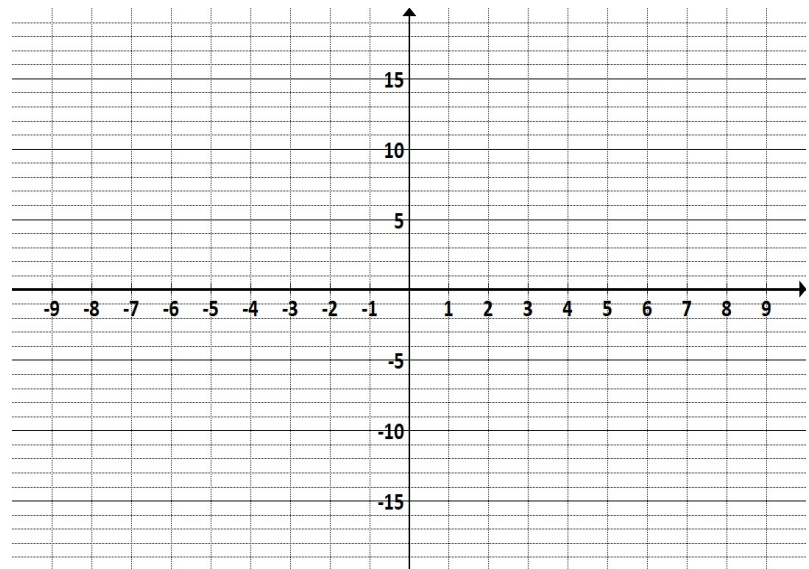
5. Given the quadratic relation $y = \frac{1}{2}(x - 5)(x + 7)$, complete the following:

[4]

a) State the values of the zeroes: _____

b) Determine the axis of symmetry (show work):

c) Determine the vertex (show work):



d) Graph the parabola, showing the roots, the vertex and at least two more exact points.

6. **Algebraically** determine the equation in **vertex form** of the parabola that has a vertex of $(4, -20)$ and has a y -intercept of -5 .

[3]

| Vertex Form $y = a(x - h)^2 + k$ | Factored Form $y = a(x - r)(x - s)$ |
|-------------------------------------|--|
|-------------------------------------|--|

7. Fill in the blanks.

[7]

a) State the transformations to $y = x^2$ for the relation $y = -\frac{1}{12}(x + 5)^2 - 2$. Use proper math terminology.

b) State the equation in **vertex form** of a parabola that has an axis of symmetry at $x = 11$, has been vertically stretched by a factor of 7 and that has neither been vertically translated nor reflected. _____

c) For the quadratic defined by $y = 3x^2 - 7$,
 the vertex is _____,
 the direction of opening is _____ and
 the range is _____.

d) How many x -intercepts does the parabola $y = 5(x - 3)^2 + 4$ have? _____

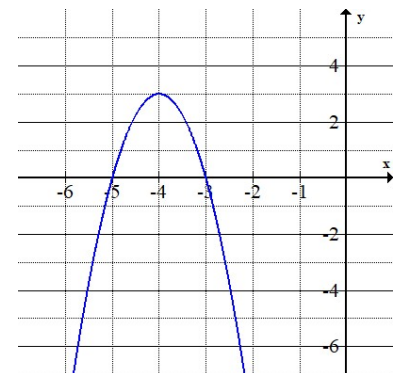
e) If the quadratic $y = x^2$ is vertically compressed by a factor of 3, the original point $(6, 36)$ becomes _____.

8. For the following graph:

[4]

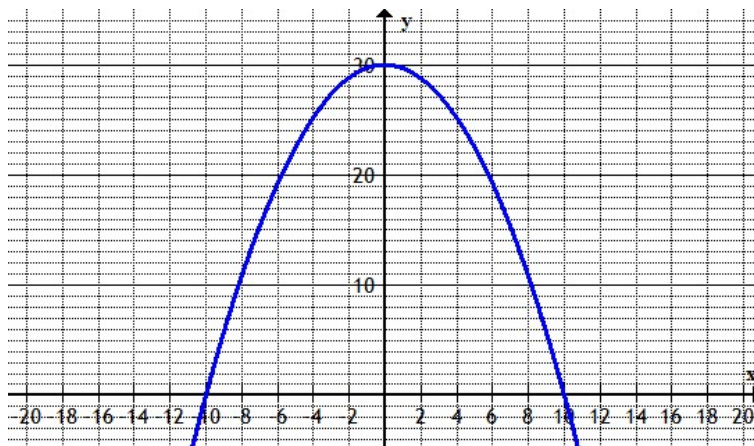
a) Without calculating, use the graph to state the equation of the quadratic relation in vertex form

b) Without calculating, use the graph to state the equation of the quadratic relation in factored form



9. An arch is in the shape of a parabola that can be approximated by the relation $y = -0.3x^2 + 30$, where y is the arch's height above the ground in metres and x is the width, in metres, from the centre of the arch. A graph of this relation is shown to the right. [3]

In order to answer the following questions, change the placement of the arch along the x -axis. Explain your change in words or show on the graph.



a) State the new equation of the graph in vertex form:

b) Explain what part(s) of the equation needed to change and **why**.

c) Explain what part(s) of the equation did **not** need to change and **why**.

10. **Algebraically** determine the **equation**, in both **factored** and **vertex** forms, of the parabola that would pass through the points given in the graph below. Use methods consistent with our lessons from Unit 3. [4]

