

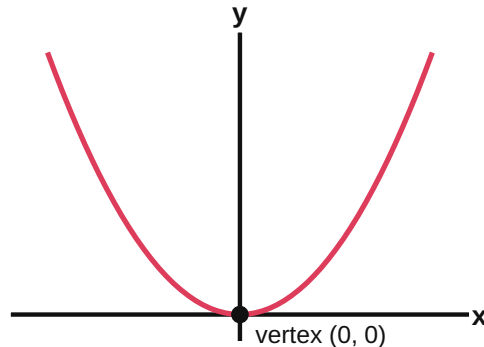
Boost Free Lessons - Year 10 Maths

Lesson 14: Exploring Parabolas

Name: _____ Grade: _____ Date: _____

Worked Example 1

Describe the graph of $y = x^2$.



1. Substitute a few x values: when $x = -2$, $y = 4$; when $x = -1$, $y = 1$; when $x = 0$, $y = 0$.
2. Squaring any number gives a positive result or zero, so the curve never goes below the x -axis.
3. The U-shaped curve is called a parabola, and its lowest point $(0, 0)$ is the vertex.
4. The graph is symmetrical about the y -axis, which is called the axis of symmetry.

a parabola with vertex $(0, 0)$

Worked Example 2

Describe how $y = x^2 - 4$ differs from $y = x^2$.

1. Subtracting 4 lowers every y value by 4, so the whole curve shifts **down** 4 units.
2. The shape and width stay exactly the same.
3. The vertex moves from $(0, 0)$ to $(0, -4)$.
4. The x -intercepts are where $y = 0$: $x^2 - 4 = 0$, so $x = 2$ and $x = -2$.

same shape, moved down 4, vertex $(0, -4)$

Remember: $y = x^2 + c$ moves the parabola up or down by c . A negative in front of x^2 flips it upside down, and a number bigger than 1 in front makes it narrower.



Question 1: State the vertex of each parabola, and note if it opens downwards.

1. $y = x^2$

2. $y = x^2 + 3$

3. $y = x^2 - 5$

4. $y = -x^2$

5. $y = x^2 + 1$

6. $y = -x^2 + 4$

7. $y = 2x^2$

8. $y = x^2 - 9$



Question 2: Find the x-intercepts of each parabola.

1. $y = x^2 - 1$

2. $y = x^2 - 16$

3. $y = x^2 - 25$

4. $y = x^2 + 4$

5. $y = x^2 - 36$

6. $y = 4 - x^2$



Question 3: Answer the following questions.

1. For $y = x^2$, find y when $x = -4$.
2. Explain why $y = x^2$ never gives a negative y value.
3. Find the vertex and the y -intercept of $y = x^2 - 7$.
4. Describe the difference between the graphs of $y = x^2$ and $y = -x^2$.
5. A ball's height is given by $h = 20 - 5t^2$. Find its height when $t = 0$ and when $t = 2$.





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Answers: Exploring Parabolas**Question 1**

1. (0, 0)
2. (0, 3)
3. (0, -5)
4. (0, 0), opening downwards
5. (0, 1)
6. (0, 4), opening downwards
7. (0, 0), narrower than $y = x^2$
8. (0, -9)

Question 2

1. $x = 1$ and $x = -1$
2. $x = 4$ and $x = -4$
3. $x = 5$ and $x = -5$
4. None, the curve never crosses the x-axis
5. $x = 6$ and $x = -6$
6. $x = 2$ and $x = -2$

Question 3

1. $y = 16$
2. Squaring any number gives a positive result or zero.
3. Vertex (0, -7), y-intercept (0, -7)
4. They are the same shape, but $y = -x^2$ is reflected and opens downwards.
5. 20 m at $t = 0$, and 0 m at $t = 2$

