Using features of a parabola to solve problems

Mana Maths

Te reo Māori terms

whārite pūrua
quadratic equation
Open in Te Aka

koi
vertex
Open in Te Aka

haukotinga
intercept
Open in Te Aka

hangarite
symmetry
Open in Te Aka

Using features of a parabola to solve problems — Foundation

For each parabola, use the vertex, intercepts and symmetry to answer.

1. For $y = (x - 0)^2 - 4$, write the vertex and both x-intercepts.

2. For $y = -(x - 0)^2 + 9$, write the vertex and the maximum value of y.

3. For $y = (x - 2)^2 - 1$, write the axis of symmetry and the vertex.

4. For $y = (x + 3)^2 - 4$, write both x-intercepts.

5. For $y = -(x - 1)^2 + 4$, write both x-intercepts.

6. For $y = (x - 0)^2 + 5$, write the vertex and say whether there are any x-intercepts.

7. For $y = (x + 1)^2 - 9$, write the axis of symmetry and both x-intercepts.

8. For $y = -(x + 2)^2 + 1$, write the vertex and the greatest value of y.

9. For $y = (x - 4)^2$, write the vertex and the x-intercept.

10. For $y = (x-1)^2 - 4$, the graph models a ball path. When is the ball on the ground?

11. For $y = -(x-3)^2 + 9$, what is the highest point on the graph?

12. For $y = (x+2)^2 - 1$, one point is $(-1, 0)$. Use symmetry to write the other x-intercept.

Using features of a parabola to solve problems — Proficient

Use features of each parabola to answer the problem.

1. A tunnel is modelled by $y = -(x - 0)^2 + 16$. What is the maximum height? What is the width at ground level?

2. A projectile follows $y = -(x - 2)^2 + 9$. At which two x-values is it on the ground?

3. For $y = (x + 1)^2 - 4$, write the interval of x for which the graph is below the x-axis.

4. For $y = -(x - 3)^2 + 1$, write the interval of x for which the graph is above the x-axis.

5. For $y = (x - 0)^2 - 9$, use symmetry to find the two points where $y = -5$.

6. For $y = -(x + 2)^2 + 4$, use symmetry to find the second point if one point is $(-1, 3)$.

7. A toy rocket follows $y = -(x-4)^2 + 25$. How high does it go? When does it land?

8. For $y = (x-2)^2$, explain why the graph only touches the x-axis once.

9. For $y = \frac{1}{2}(x-1)^2 - 2$, estimate both x-intercepts to 1 decimal place.

10. For $y = -\frac{1}{2}(x+1)^2 + 3$, estimate both x-intercepts to 1 decimal place.

11. For $y = (x+4)^2 - 9$, one root is $x = -1$. Use symmetry to find the other root.

12. For $y = -(x-1)^2 + 8$, for which x-values is the graph non-negative?

Using features of a parabola to solve problems — Excellence

Use features of each parabola to justify your answers.

1. For $y = -(x-2)^2 + 9$, find the maximum value, both roots, and the interval where $y \geq 5$.

2. For $y = (x+1)^2 - 16$, find the roots and the interval where $y < 0$.

3. For $y = -2(x-0)^2 + 8$, compare its width with $y = -x^2 + 8$. Which is narrower, and why?

4. For $y = \frac{1}{2}(x-3)^2 - 2$, estimate both roots to 1 decimal place and state the axis of symmetry.

5. For $y = -(x+4)^2 + 1$, determine whether the point $(-6, -3)$ lies on the graph without expanding.

6. For $y = (x-2)^2 - 9$, find two different points with $y = -5$.

7. For $y = -(x-1)^2 + 4$, the graph represents profit. For which x-values is profit positive?

8. For $y = (x+3)^2 - 4$, one root is $x = -1$. Use symmetry to find the other root, then check by inspection.

9. For $y = -\frac{1}{2}(x-2)^2 + 6$, estimate the interval where $y > 4$.

10. For $y = 2(x+1)^2 - 8$, find the roots and explain how the factor 2 changes the shape.

11. For $y = -(x-0)^2 + 12$, a jump lasts while $y \geq 3$. Find the horizontal interval for the jump.

12. For $y = (x-4)^2 + 1$, explain why there are no real roots.

13. For $y = -(x+2)^2 + 9$, find the y-intercept and use symmetry to find another point with the same height.

14. For $y = (x-1)^2 - 4$, find all x-values where the graph is at most 5.