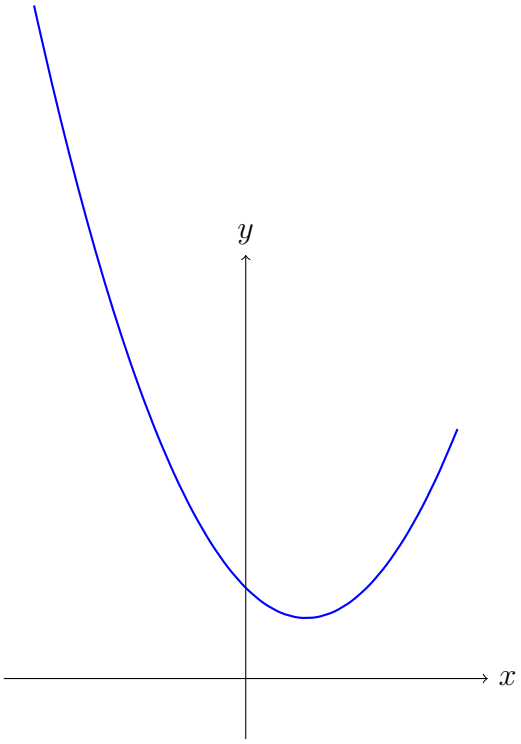
ILLAWARRA TUTORING

In this worksheet you will learn how to find the axis of symmetry in a parabola. You will practise identifying the axis both from standard quadratic forms and vertex forms. Recall that for a quadratic function $y = ax^2 + bx + c$, the axis of symmetry is given by $x = -\dfrac{b}{2a}$, and for a vertex form $y = a(x - h)^2 + k$ the axis is $x = h$.

Easy Questions

1. Write in your own words the definition of the axis of symmetry for a parabola.
2. Determine the axis of symmetry for $y = x^2$.
3. Find the axis of symmetry for $y = 2x^2$.
4. Identify the axis of symmetry for $y = (x - 3)^2$.
5. Below is a diagram of a parabola. Mark the axis of symmetry on the diagram.



Type the equation of the axis of symmetry.

Intermediate Questions

6. Find the axis of symmetry for $y = 3x^2 - 6x + 4$.
7. Find the axis of symmetry for $y = -2x^2 + 8x - 3$.
8. Determine the vertex and the axis of symmetry for $y = x^2 + 4x + 1$.
9. Calculate the axis of symmetry for $y = -x^2 + 2x + 3$.
10. Write $y = 2x^2 - 12x + 9$ in vertex form and state its axis of symmetry.
11. Use the formula $x = -\dfrac{b}{2a}$ to find the axis of symmetry for $y = -5x^2 + 20x - 15$.
12. Find the axis of symmetry for $y = 4x^2 - 4x + 1$.
13. Identify the axis of symmetry for $y = (x + 1)^2 - 5$.
14. For $y = -3(x - 2)^2 + 7$, determine the axis of symmetry.
15. Calculate the axis of symmetry for $y = 5x^2 + 5x + 1$.
16. Find the axis of symmetry for $y = x^2 - 8x + 15$.
17. A parabola has its vertex at $(2, 3)$ and opens upwards. State its axis of symmetry.
18. Express the equation of the axis of symmetry as a line for $y = 3x^2 + 6x + 4$.
19. Given a quadratic in vertex form $y = a(x - h)^2 + k$, state the axis of symmetry in terms of h.
20. The axis of symmetry of a parabola is given as $x = -3$. Write an expression for a quadratic function in vertex form that has its vertex on this line.

Hard Questions

21. Derive the formula for the axis of symmetry for a quadratic equation $y = ax^2+bx+c$.
22. For $y = 2x^2 + bx + 3$, determine the value(s) of b such that the axis of symmetry is $x = 1$.
23. Prove that the axis of symmetry of a parabola always passes through its vertex.
24. A quadratic function $y = ax^2 + bx + c$ has an axis of symmetry $x = 2.5$ and passes through the points $(0, 6)$ and $(5, 6)$. Determine the quadratic function.
25. The function $y = ax^2 + bx + c$ has its vertex at (h, k). Explain how to derive the axis of symmetry from the vertex form and then find it for $y = 3(x - 4)^2 - 5$.
26. For $y = ax^2 + bx + c$, show that if the axis of symmetry is $x = p$, then $f(p + h) = f(p - h)$ holds for any real number h.
27. Let $y = 2x^2 + bx + c$ be a quadratic function that has its vertex at $(-2, k)$ (hence the axis is $x = -2$). Express b and c in terms of a and k.

28. Given two quadratic functions $f(x) = ax^2 + bx + c$ and $g(x) = dx^2 + ex + f$ share the same axis of symmetry, explain what relationship must exist between the coefficients a, b and d, e.

29. A quadratic function is given by $f(x) = a(x-1)^2 + 2$. Determine the new axis of symmetry if the function is translated 3 units to the left.

30. Consider a quadratic function $y = ax^2 + bx + c$. If a miscalculation leads to an incorrect axis of symmetry $x = -\dfrac{b+2}{2a}$, explain the likely error made during the calculation.