Year 9 Quadratics and Parabolas - Practice Test 1

14 questions | 50 marks

Award the shown method marks for equivalent correct working.

1. Expand and simplify $(x+3)(x+2)$. [2 marks]

Multiply every term: $x^2+2x+3x+6$. [1]
Collect the middle terms: x^2+5x+6. [1]
Answer: x^2+5x+6

2. Factorise $x^2+7x+12$. [2 marks]

Find two numbers with product 12 and sum 7: 3 and 4. [1]
Write the factors: $(x+3)(x+4)$. [1]
Answer: $(x+3)(x+4)$

3. Expand and simplify $(x-4)(x+4)$. [2 marks]

Expand: $x^2+4x-4x-16$. [1]
The middle terms cancel, leaving x^2-16. [1]
Answer: x^2-16

4. [3 marks]

(a) Factorise $x^2 - 6x + 9$.

Factorise: $x^2 - 6x + 9 = (x - 3)^2$. [1]

Answer: $(x - 3)^2$.

(b) Hence solve $x^2 - 6x + 9 = 0$.

Set $x - 3 = 0$ to obtain $x = 3$. The two equal factors give the same solution. [1]

Answer: $x = 3$, a repeated root.

(c) Factorise $x^2 - 5x$ fully.

Take out the common factor x: $x(x - 5)$. [1]

Answer: $x(x - 5)$.

5. Solve $x^2 - 7x + 12 = 0$. Show your working. [3 marks]

Factorise: $(x - 3)(x - 4) = 0$. [1]

Set either factor equal to zero: $x - 3 = 0$ or $x - 4 = 0$. [1]

The solutions are $x = 3$ and $x = 4$. [1]

Answer: $x = 3$ or $x = 4$.

6. Solve $x^2 + 5x + 6 = 0$. Show your working. [3 marks]

Factorise: $(x + 2)(x + 3) = 0$. [1]

Set either factor equal to zero: $x + 2 = 0$ or $x + 3 = 0$. [1]

The solutions are $x = -2$ and $x = -3$. [1]

Answer: $x = -2$ or $x = -3$.

7. Use the rule $y = x^2 - 4$. [4 marks]

Table of values

x	-3	-2	-1	0	1	2	3
y							

(a) Complete the table.

Substitute the seven x values. Award 2 marks for all seven correct y values; award 1 mark for three to six correct values. [2]

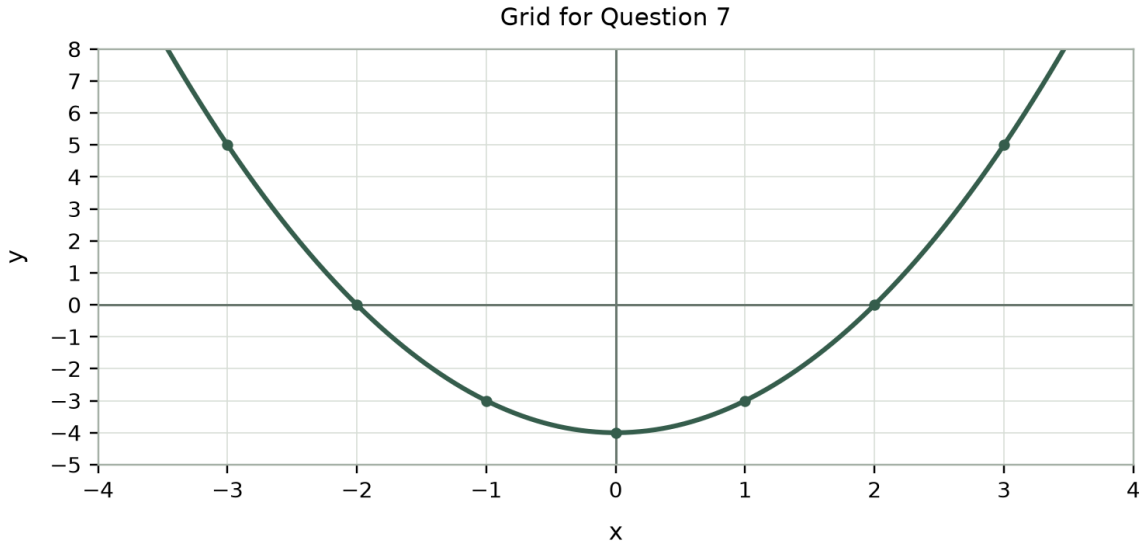
Answer: The y values are $5, 0, -3, -4, -3, 0, 5$.

(b) Plot the points on the grid and draw a smooth curve through them.

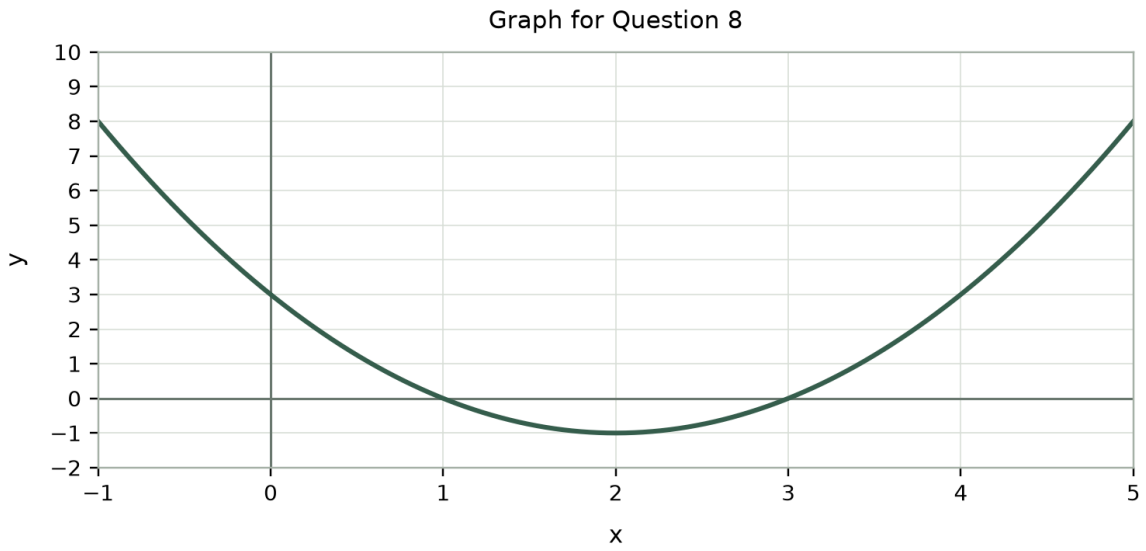
Plot the tabulated points accurately. Allow follow-through from an incorrect table value when its point is plotted correctly. [1]

Join the points with a smooth upward-opening curve, rather than straight segments. [1]

Answer: An upward-opening parabola through the seven points, with turning point $(0, -4)$.



8. Use the graph below. [4 marks]



(a) Write the coordinates of the turning point.

Read the turning point: $(2, -1)$. [1]

Answer: $(2, -1)$.

(b) Write the two x-intercepts as coordinates.

Read the intercepts: $(1, 0)$ and $(3, 0)$. Award 1 mark for each point. [2]

Answer: $(1, 0)$ and $(3, 0)$.

(c) Write the equation of the line of symmetry.

The vertical symmetry line is $x = 2$. [1]

Answer: $x = 2$.

9. A parabola has rule $y = (x - 3)^2 - 4$. [4 marks]

(a) Write its turning point.

At $x = 3$, the squared term is zero, so the turning point is $(3, -4)$. Award 1 mark for each correct coordinate. [2]

Answer: $(3, -4)$.

(b) Write its line of symmetry.

The line of symmetry is $x = 3$. [1]

Answer: $x = 3$.

(c) Is the turning point a minimum or a maximum? Explain briefly.

A minimum: the squared term is non-negative, so y cannot be less than -4. Accept an explanation that the parabola opens upwards. [1]

Answer: A minimum, because the coefficient of the squared term is positive and the parabola opens upwards.

10. A parabola has rule $y = (x - 2)(x + 4)$. [4 marks]

(a) Find its two x-intercepts.

Set each factor equal to zero: the intercepts are $(2, 0)$ and $(-4, 0)$. Award 1 mark for each point; accept the corresponding x values. [2]

Answer: $(2, 0)$ and $(-4, 0)$.

(b) Expand the rule.

Expand to obtain $y = x^2 + 2x - 8$. [1]

Answer: $y = x^2 + 2x - 8$.

(c) Find its y-intercept.

Substitute $x = 0$ to obtain the intercept $(0, -8)$. [1]

Answer: $(0, -8)$.

11. The rectangle below has area 48 square centimetres. Its width is x centimetres and its length is $(x+2)$ centimetres. [5 marks]

Rectangle for Question 11



(a) Write an equation for its area.

Area equals width times length: $x(x+2)=48$. [1]

Answer: $x(x+2)=48$.

(b) Solve the equation.

Rearrange and factorise: $x^2+2x-48=(x+8)(x-6)=0$. [1]

Therefore $x=6$ or $x=-8$. [1]

Answer: $x=6$ or $x=-8$.

(c) State the rectangle's width and length. Explain why one solution cannot be used.

The width is 6 cm and the length is 8 cm. [1]

Reject $x=-8$ because dimensions must be positive. [1]

Answer: Width 6 cm and length 8 cm; a length cannot be negative.

12. A rectangular garden has perimeter 24 metres. Its width is x metres. [5 marks]

(a) Write its length in terms of x.

Half the perimeter is 12 m, so length plus width is 12 m and the length is $12 - x$ m. [1]

Answer: $12 - x$ metres.

(b) Show that its area is $A = 12x - x^2$.

Multiply the dimensions: $A = x(12 - x) = 12x - x^2$. [1]

Answer: $A = x(12 - x) = 12x - x^2$.

(c) The area is 35 square metres. Find the two possible values of x.

Rearrange $12x - x^2 = 35$ to $x^2 - 12x + 35 = 0$ and factorise as $(x - 5)(x - 7) = 0$. [1]

The possible widths are $x = 5$ m and $x = 7$ m. [1]

Answer: $x = 5$ or $x = 7$.

(d) Explain why these two values describe the same pair of garden dimensions.

When the width is 5 m the length is 7 m, and vice versa. They are the same rectangle with the dimensions exchanged. [1]

Answer: The dimensions are 5 m by 7 m in either order.

13. In an animation, a ball's height is modelled by $h = t(6 - t)$ for $0 \le t \le 6$. Here h is the height in metres and t is the time in seconds. [5 marks]

(a) Find the height at $t = 2$.

$h = 2(6 - 2) = 8$ m. [1]

Answer: 8 m.

(b) Find both times when the ball is at ground level.

At ground level $h = 0$, so $t(6 - t) = 0$. This gives $t = 0$ s or $t = 6$ s. Award 1 mark for each correct time. [2]

Answer: 0 s and 6 s.

(c) Use symmetry to find when the ball reaches its greatest height, then find that height.

By symmetry, the greatest height occurs halfway between the ground-level times: $t = 3$ s. [1]

Substitute: $h = 3(6 - 3) = 9$ m. [1]

Answer: At 3 s; the greatest height is 9 m.

14. Mia solves $(x + 1)(x - 4) = 0$ by dividing both sides by $x + 1$. She writes $x = 4$ as the only solution. [4 marks]

(a) Give both solutions to the original equation.

Set each factor equal to zero: $x = -1$ or $x = 4$. Award 1 mark for each solution. [2]

Answer: $x = -1$ or $x = 4$.

(b) Check the missing solution in the original equation.

Substitute $x = -1$: $(-1 + 1)(-1 - 4) = 0(-5) = 0$. [1]

Answer: At $x = -1$, $(x + 1)(x - 4) = 0(-5) = 0$.

(c) Why is it unsafe to divide by $x + 1$ here?

At $x = -1$, the divisor $x + 1$ is zero. Dividing by it loses a valid solution because division by zero is undefined. Accept an equivalent clear explanation. [1]

Answer: $x + 1$ can be zero, and division by zero is not allowed; the division discards $x = -1$.