REVISE
.wales

3.09 — Reciprocal, exponential & cubic graphs

Mark schemes for the 3.09 question pack

Spec 2.4.8, 2.4.9, 2.4.11 — Unit 3

SOLUTIONS · 2025 SPECIFICATION

Mark schemes for the 12 questions in the corresponding revise.wales question pack (48 marks total). Sources: legacy WJEC GCSE papers, WJEC SAM, and custom-authored mark schemes. Pack layout © revise.wales.

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15. TRUE FALSE TRUE FALSE		B2	B1 for any 3 correct responses.
16. $(3x-1)^2 = 9x^2 - 3x - 3x + 1$	✓	B1	
$\ldots = 2x^2 + 3x + 7$	✓	B1	
$7x^2 - 9x - 6 = 0$	✓	B1	CAO. '= 0' may be implied in further working.
$(x =)\ \dfrac{-(-9)\pm\sqrt{(-9)^2-4\times7\times(-6)}}{2\times7}$	✓	M1	FT 'their derived quadratic equation' set to zero and of equivalent level of difficulty (a, b and c are non-zero). Allow one slip in substitution, but must be correct formula.
$= \dfrac{9\pm\sqrt{249}}{14}$	✓	A1	If one slip seen or a positive b used award A0.
$x = 1.77$ AND $x = -0.48$ (answers to 2dp)	✓	A1	CAO

16)

Graph A

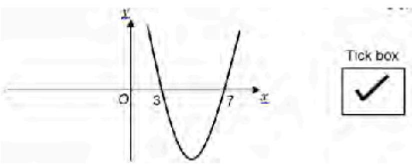
$y = 7x^2$	
$y = -(x+7)^2$	
$y = (x-7)^2$	
$y = 7 - x^2$	✓
$y = x^2 + 7$	

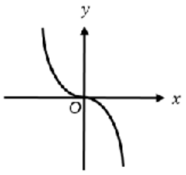
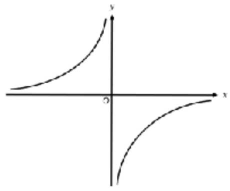
B1

Graph B

$y = x^2 + 1$	
$y = 2^x$	✓
$y + 1 = x^2$	
$y = \frac{1}{x}$	
$y = x^0$	

B1

		$k(k^2p - p^3)$ OR $p(k^3 - kp^2)$ is B0
17. 	B1	If more than one graph indicated, award B0.

16.(a) 	B1	Third box
16.(b) Correct sketch of $y = -1/x$ in appropriate 2 quadrants with axes as asymptotes with no extra curves in the other quadrants. 	B2	Penalise -1 for the curling away from the asymptotes at the extremities only if B2 previously awarded. If not B2, award B1 for one of the following: • Correct sketch in 1 quadrant with axes as asymptotes with no more than 1 incorrect curve in another quadrant • Correct sketch in appropriate 2 quadrants with axes as asymptotes with extra incorrect curves in one or two of the other quadrants • for two curves sketched appropriately in both quadrants but not clearly with intention of axes as asymptotes • Correct sketch of $y = +1/x$ in appropriate 2 quadrants with axes as asymptotes.

(a) Correct S-shape passing through origin; passes through (1, 1), (2, 8), (−1, −1), (−2, −8) area; smooth curve [B1]

Labelled (0, 0) (only intercept) [B1]

(b) Same shape, translated up by 20 [B1]

y-intercept labelled at (0, 20); x-intercept around $x \approx -2.71$ (allow unlabelled) [B1]

(a) Two branches in opposite quadrants (1st and 3rd) [B1]

Approaching but not touching both axes [B1]

Smooth, symmetric — passes through approximate points (1, 6), (2, 3), (3, 2), (6, 1), (−1, −6), (−2, −3) etc. [B1]

(b) $x = 0$ and $y = 0$ (both required) [B1]

(a) $x = -2$, $x = 1$, $x = 3$ [B1]

(b) Correct cubic shape going from bottom-left to top-right (positive leading coefficient) [B1]

Crosses x-axis at all three correct points [B1]

y-intercept at (0, 6) labelled [B1]

Local max between $x = -2$ and $x = 1$, local min between $x = 1$ and $x = 3$ — both shown correctly [B1]

(a) All 7 points plotted correctly [B2; B1 for 5 or 6 correct]

Smooth curve drawn through points (no straight-line segments, no lifts) [B1]

(b) Solutions where curve crosses x-axis:

$x \approx -2.7$, $x \approx 0.7$, $x = 2$ [B1 for each, ±0.2 tolerance]

(Three roots are required for full marks.)

A → (iii) [B1]

B → (v) [B1]

C → (iv) [B1]

D → (ii) [B1]

E → (i) [B1]

(a) TRUE. $y = x^3 - 9x = x(x^2 - 9) = x(x - 3)(x + 3)$, so roots are at 0, 3, −3 [B1 for TRUE, B1 for valid factorisation reason]

(b) FALSE. $y = x^3 + 9x = x(x^2 + 9)$; $x^2 + 9 = 0$ has no real solutions, so only root is $x = 0$ [B1 for FALSE, B1 for reason — no real roots from $x^2 + 9$]

(c) FALSE. $y = x(x^2 - 9) + 1$ does not pass through the origin (when $x = 0$, $y = 1$) [B1]

(a) (5, 0) and (−5, 0) [B1]

(b) $3^2 + y^2 = 25 \rightarrow y^2 = 16$ [M1]

$y = 4$ or $y = -4$ [A1]

(c) For most values of x there are two corresponding values of y (e.g. for $x = 3$, $y = 4$ and $y = -4$) [B1]

A function gives only one output for each input, so this is not a function [B1]

(a) Correct cubic shape through origin [B1]

Straight line with y-intercept (0, 2) and gradient 3 [B1]

(b) Intersections at $x = -1$ (repeated root, line tangent to curve at $x = -1$) and $x = 2$ [M1 for identifying repeated root behaviour]

$x = -1$ and $x = 2$ (1 d.p.) [A1, A1]

(c) 3 real roots (counting the repeated root at $x = -1$ twice) — accept "2 distinct real roots, one of which is repeated" [B1]

End of solutions