

AS and A-level MATHS

Simultaneous equations, linear and quadratic inequalities

Mark scheme

Specification content coverage: B4, B5, B6

Question	Solutions	Mark												
1	$a = 3 \quad b = -5 \quad c = 4$ $b^2 - 4ac = 25 - 4 \times 3 \times 4$ $= -23$ Therefore no solutions	1 1 2												
2	$-2x < -6$ or $6 < 2x$ $x > 3$ or $3 < x$	1 1												
3	$x^2 + 5x - 3 = 2x + 1$ $x^2 - 3x - 4 = 0$ $x = -4$ or $x = 1$	1 1 1												
4	<table border="1" style="margin-left: auto; margin-right: auto;"> <tbody> <tr> <td></td> <td>x^2</td> <td>$-3x$</td> <td>6</td> </tr> <tr> <td>2x</td> <td>$2x^3$</td> <td>$-6x^2$</td> <td>12x</td> </tr> <tr> <td>+3</td> <td>$3x^2$</td> <td>$-9x$</td> <td>18</td> </tr> </tbody> </table> $2x^3 - 3x^2 + 3x + 18$		x^2	$-3x$	6	2x	$2x^3$	$-6x^2$	12x	+3	$3x^2$	$-9x$	18	1 Six correct terms 1
	x^2	$-3x$	6											
2x	$2x^3$	$-6x^2$	12x											
+3	$3x^2$	$-9x$	18											
5	(a) $P(2) = 2^3 + 4(2)^2 - 19(2) + 14$ $= 8 + 16 - 38 + 14 = 0$ ($x - 2$) is a factor (b) <table border="1" style="margin-left: auto; margin-right: auto;"> <tbody> <tr> <td></td> <td>x^2</td> <td>$6x$</td> <td>-7</td> </tr> <tr> <td>x</td> <td>x^3</td> <td>$6x^2$</td> <td>$-7x$</td> </tr> <tr> <td>-2</td> <td>$-2x^2$</td> <td>$-12x$</td> <td>14</td> </tr> </tbody> </table> $(x-2)(x+7)(x-1)$		x^2	$6x$	-7	x	x^3	$6x^2$	$-7x$	-2	$-2x^2$	$-12x$	14	1 1 1 method: at most one error 1 for correct quotient 1
	x^2	$6x$	-7											
x	x^3	$6x^2$	$-7x$											
-2	$-2x^2$	$-12x$	14											
6	$P(-2) = -24 + 4b + 2c + 5 = 0$ $P(3) = 81 + 9b - 3c + 5 = 0$	1 1												

	<p>Solve sim equation</p> $b = -23/6$ $c = 103/6$	<p>1</p> <p>1</p>
7	$x - 5 = x^2 + 6x + 13$ $x^2 + 5x + 8 = 0$ $a = 1 \quad b = 5 \quad c = 8$ $b^2 - 4ac = 25 - 4 \times 8 = -23 \text{ therefore } b^2 - 4ac < 0 \text{ no roots, lines do not intersect}$ <p>or by completing square</p> $(x + 5/2)^2 + 7/4 = 0$ $(x + 5/2)^2 \text{ has to be greater than zero, there can be no solution as quadratic has min } 7/4$	<p>1</p> <p>1</p> <p>2 (must include concluding statement)</p>
8	$c = 16 \text{ (y intercept } x = 0, y = d)$ $2 \times -4 \times k = 16 \text{ (examining constant terms of linear product and roots)}$ $k = 20/-8 = -2$ $(x + 2)(x - 4)(x - 2) = x^3 - 4x^2 - 4x + 16$	<p>1</p> <p>1</p> <p>2</p>
9	<p>Find quotient</p> $x^2 + 4x - 5$ <p>Solve quotient to find other roots $x = -5$ and $x = 1$</p> <p>By sketching graph or otherwise find inequalities</p> $-5 < x < 1 \text{ or } x > 2$	<p>2</p> <p>1</p> <p>2</p>

Rationale

It is assumed that students are proficient at using calculator to solve quadratics/simultaneous equations.

15 marks scaffolded, with basic skill assessed

17 marks applying, including some basic proof and some more advanced problem-solving