C1

1.	(*a*)	Gradient of $AB = \dfrac{\text{increase in } y}{\text{increase in } x}$		M1
		Gradient of $AB = -{}^{4}/_{3}$	(or equivalent)	A1
	(*b*)	A correct method for finding C		M1
		$C(-1, 3)$		A1
	(*c*)	Use of $m_{AB} \times m_L = -1$ to find gradient of L		M1
		A correct method for finding the equation of L using candidate's coordinates for C and candidate's gradient for L.		M1
		Equation of L: $y - 3 = {}^{3}/_{4}[x - (-1)]$	(or equivalent)	
		(f.t. candidate's coordinates for C and candidate's gradient for AB)		A1
		Equation of L: $3x - 4y + 15 = 0$	(convincing, c.a.o.)	A1
	(*d*)	(i) Substituting $x = 7$, $y = k$ in equation of L		M1
		$k = 9$		A1
		(ii) A correct method for finding the length of $CA(DA)$		M1
		$CA = 5$	(f.t. candidate's coordinates for C)	A1
		$DA = \sqrt{125}$		A1
		(iii) $\text{Sin } ADC = \dfrac{CA}{DA} = \dfrac{5}{\sqrt{125}}$		
		(f.t. candidate's derived values for CA and DA)		M1
		$\text{Sin } ADC = \dfrac{CA}{DA} = \dfrac{1}{\sqrt{5}}$	(c.a.o.)	A1

2. (*a*) $\dfrac{10}{7 + 2\sqrt{11}} = \dfrac{10(7 - 2\sqrt{11})}{(7 + 2\sqrt{11})(7 - 2\sqrt{11})}$ M1

Denominator: $49 - 44$ A1

$\dfrac{10}{7 + 2\sqrt{11}} = \dfrac{10(7 - 2\sqrt{11})}{5} = 2(7 - 2\sqrt{11}) = 14 - 4\sqrt{11}$ (c.a.o.) A1

Special case

If M1 not gained, allow B1 for correctly simplified denominator following multiplication of top and bottom by $7 + 2\sqrt{11}$

(*b*) $(4\sqrt{3})^2 = 48$ B1

$\sqrt{8} \times \sqrt{50} = 20$ B1

$\dfrac{5\sqrt{63}}{\sqrt{7}} = 15$ B1

$(4\sqrt{3})^2 - (\sqrt{8} \times \sqrt{50}) - \dfrac{5\sqrt{63}}{\sqrt{7}} = 13$ (c.a.o.) B1

3. (*a*) $\dfrac{dy}{dx} = 4x - 11$ (an attempt to differentiate, at least one non-zero term correct) M1

An attempt to substitute $x = 2$ in candidate's expression for $\dfrac{dy}{dx}$ m1

Use of candidate's numerical value for $\dfrac{dy}{dx}$ as gradient of tangent at P m1

Equation of tangent at P: $y - (-1) = -3(x - 2)$ (or equivalent) (c.a.o.) A1

(*b*) Gradient of tangent at $Q = 9$ B1

An attempt to equate candidate's expression for $\dfrac{dy}{dx}$ and candidate's derived value for gradient of tangent at Q M1

$4x - 11 = 9 \Rightarrow x = 5$

(f.t. one error in candidate's expression for $\dfrac{dy}{dx}$) A1

4. $(1 - 2x)^6 = 1 - 12x + 60x^2 - 160x^3 + \ldots$ B1 B1 B1 B1

(– 1 for further incorrect simplification)

5. (*a*) $a = 3$ B1

$b = -2$ B1

$c = 17$ B1

(*b*) Stationary value = 17 (f.t. candidate's value for c) B1

This is a minimum B1

6. (*a*) An expression for $b^2 - 4ac$, with at least two of a, b, c correct M1

$b^2 - 4ac = (2k - 1)^2 - 4(k^2 - k + 2)$ A1

$b^2 - 4ac = -7$ (c.a.o.) A1

candidate's value for $b^2 - 4ac < 0$ ($\Rightarrow$ no real roots) A1

(*b*) Finding critical values $x = -6$, $x = {}^2/_3$ B1

A statement (mathematical or otherwise) to the effect that

$x < -6$ or ${}^2/_3 < x$ (or equivalent)

(f.t critical values ± 6, $\pm {}^2/_3$ only) B2

Deduct 1 mark for each of the following errors

the use of $\leq$ rather than $<$

the use of the word 'and' instead of the word 'or'

7. (*a*) $y + \delta y = 3(x + \delta x)^2 - 7(x + \delta x) + 5$ B1

Subtracting y from above to find δy M1

$\delta y = 6x\delta x + 3(\delta x)^2 - 7\delta x$ A1

Dividing by δx and letting $\delta x \to 0$ M1

$\frac{dy}{dx} = \lim_{\delta x \to 0} \frac{\delta y}{\delta x} = 6x - 7$ (c.a.o.) A1

(*b*) Required derivative = ${}^2/_3 \times {}^1/_4 \times x^{-3/4} + 12 \times (-3) \times x^{-4}$ B1, B1

8. (*a*) Attempting to find $f(r) = 0$ for some value of r M1

$f(2) = 0 \Rightarrow x - 2$ is a factor A1

$f(x) = (x - 2)(6x^2 + ax + b)$ with one of a, b correct M1

$f(x) = (x - 2)(6x^2 - 7x - 3)$ A1

$f(x) = (x - 2)(3x + 1)(2x - 3)$ (f.t. only $6x^2 + 7x - 3$ in above line) A1

$x = 2, -{}^1/_3, {}^3/_2$ (f.t. for factors $3x \pm 1$, $2x \pm 3$) A1

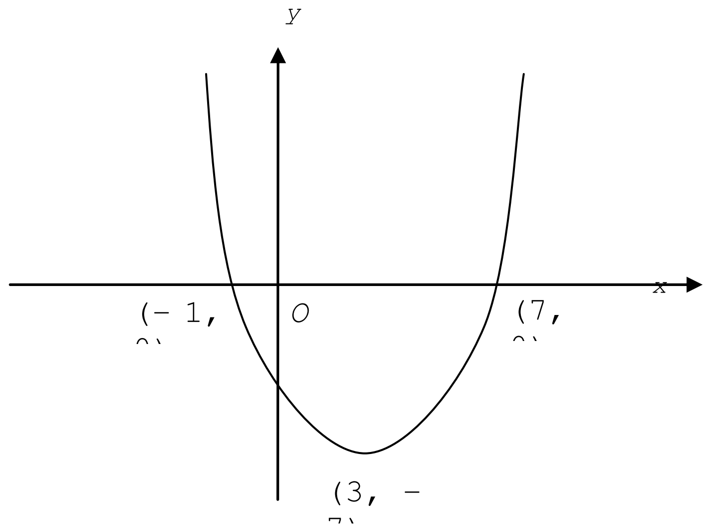
Special case

Candidates who, after having found $x - 2$ as one factor, then find one of the remaining factors by using e.g. the factor theorem, are awarded B1 for final 4 marks

(*b*) Use of $g(a) = 11$ M1

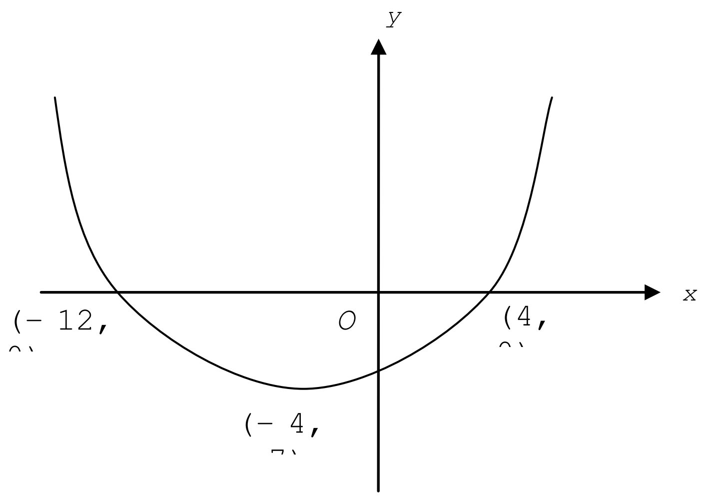
$a^3 - 53 = 11 \Rightarrow a = 4$ A1

9. (*a*)



Concave up curve and *y*-coordinate of minimum = – 7	B1
x-coordinate of minimum = 3	B1
Both points of intersection with *x*-axis	B1

(*b*)



Concave up curve and *y*-coordinate of minimum = – 7	B1
x-coordinate of minimum = – 4	B1
Both points of intersection with *x*-axis	B1

10. (*a*) $\frac{dy}{dx} = 3x^2 + 6x$ B1

Putting derived $\frac{dy}{dx} = 0$ M1

$x = 0, -2$ (both correct) (f.t. candidate's $\frac{dy}{dx}$) A1

Stationary points are $(0, -1)$ and $(-2, 3)$ (both correct) (c.a.o) A1

A correct method for finding nature of stationary points yielding

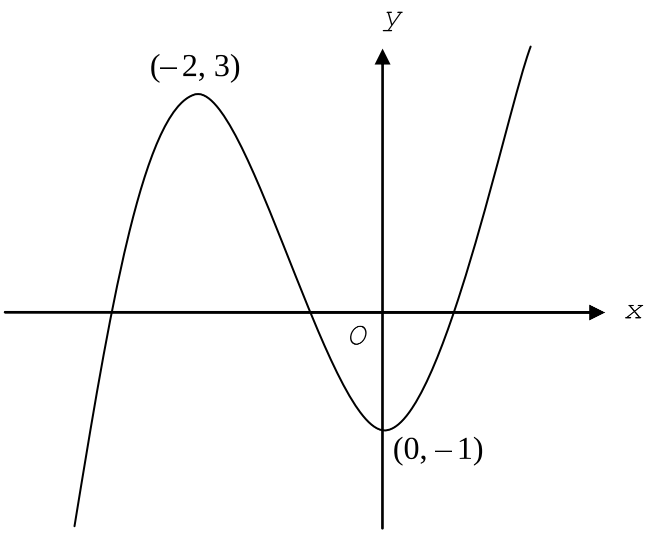
either $(0, -1)$ is a minimum point

or $(-2, 3)$ is a maximum point (f.t. candidate's derived values) M1

Correct conclusion for other point

(f.t. candidate's derived values) A1

(*b*)



Graph in shape of a positive cubic with two turning points M1

Correct marking of both stationary points

(f.t. candidate's derived maximum and minimum points) A1

(*c*) One positive root (f.t. the number of times the candidate's curve crosses the positive *x*-axis) B1