

C1

1. (a) (i) Gradient of $BC = \frac{\text{increase in } y}{\text{increase in } x}$ M1
 Gradient of $BC = -4$ (or equivalent) A1
- (ii) A correct method for finding the equation of BC using candidate's gradient for BC M1
 Equation of BC : $y - (-5) = -4(x - 6)$ (or equivalent) A1
 (f.t. candidate's gradient of BC) A1
 Equation of BC : $4x + y - 19 = 0$ (convincing) A1
- (iii) Use of $m_{AD} \times m_{BC} = -1$ M1
 A correct method for finding the equation of AD using candidate's gradient for AD (M1)
(to be awarded only if corresponding M1 is not awarded in part (ii))
 Equation of AD : $y - 4 = \frac{1}{4}(x - 8)$ (or equivalent) A1
 (f.t. candidate's gradient of BC) A1

Note: Total mark for part (a) is 7 marks

- (b) An attempt to solve equations of BC and AD simultaneously M1
 $x = 4, y = 3$ (convincing) (c.a.o.) A1
- (c) A correct method for finding the length of BD M1
 $BD = \sqrt{68}$ A1
- (d) A correct method for finding E M1
 $E(0, 2)$ A1

2. (a) $\frac{2 + 5\sqrt{7}}{4 + \sqrt{7}} = \frac{(2 + 5\sqrt{7})(4 - \sqrt{7})}{(4 + \sqrt{7})(4 - \sqrt{7})}$ M1
 Numerator: $8 - 2\sqrt{7} + 20\sqrt{7} - 35$ A1
 Denominator: $16 - 7$ A1
 $\frac{2 + 5\sqrt{7}}{4 + \sqrt{7}} = -3 + 2\sqrt{7}$ (c.a.o.) A1

Special case

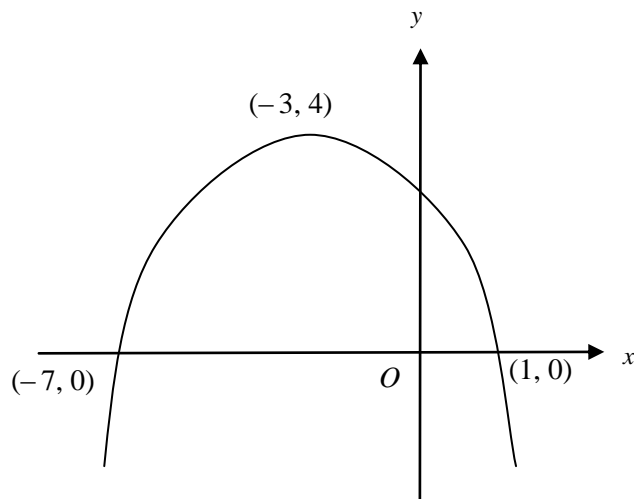
If M1 not gained, allow B1 for correctly simplified numerator or denominator following multiplication of top and bottom by $4 + \sqrt{7}$

- (b) $\sqrt{360} = 6\sqrt{10}$ B1
 $\sqrt{2} \times (\sqrt{5})^3 = 5\sqrt{10}$ B1
 $\frac{\sqrt{30} \times \sqrt{8}}{\sqrt{6}} = 2\sqrt{10}$ B1
 $\sqrt{360} - \sqrt{2} \times (\sqrt{5})^3 - \frac{\sqrt{30} \times \sqrt{8}}{\sqrt{6}} = -\sqrt{10}$ (c.a.o.) B1

3. (a) $\frac{dy}{dx} = 4x - 10$ (an attempt to differentiate, at least one non-zero term correct) M1
 An attempt to substitute $x = 3$ in candidate's expression for $\frac{dy}{dx}$ m1
 Value of $\frac{dy}{dx}$ at $P = 2$ (c.a.o.) A1
 Use of gradient of normal = $\frac{-1}{\text{candidate's value for } \frac{dy}{dx}}$ m1
 Equation of normal at P : $y - (-5) = -\frac{1}{2}(x - 3)$ (or equivalent) (f.t. candidate's value for $\frac{dy}{dx}$ provided M1 and both m1's awarded) A1
- (b) An attempt to put candidate's expression for $\frac{dy}{dx} = 0$ M1
 x -coordinate of $Q = 2.5$ (f.t. one error in candidate's expression for $\frac{dy}{dx}$) A1
4. (a) $2(x - 4)^2 - 40$ B1 B1 B1
 (b) least value = -20 (f.t. candidate's value for c) B1
 x -coordinate = 4 (f.t. candidate's value for b) B1
5. (a) $(1 + 2x)^7 = 1 + 14x + 84x^2 \dots$ B1 B1 B1
 (b) $(1 - 4x)(1 + 2x)^7 = 1 - 4x + 14x - 56x^2 + 84x^2$
 Constant term and terms in x B1
 Terms in x^2 B1
 (f.t. candidate's expression in (a))
 $(1 - 4x)(1 + 2x)^7 = 1 + 10x + 28x^2$ (c.a.o.) B1

6. (a) (i) An expression for $b^2 - 4ac$, with at least two of a, b, c correct
M1
 $b^2 - 4ac = (4k + 1)^2 - 4 \times (k + 1) \times (k - 5)$ A1
Putting $b^2 - 4ac = 0$ m1
 $4k^2 + 8k + 7 = 0$ (convincing) A1
- (ii) An expression for $b^2 - 4ac$, with at least two of a, b, c correct
(M1)
(to be awarded only if corresponding M1 is not awarded in part (i))
 $b^2 - 4ac = 64 - 112 (= -48)$ A1
 $b^2 - 4ac < 0 \Rightarrow$ no real roots A1
- Note: Total mark for part (a) is 6 marks**
- (b) Finding critical values $x = -3/4, x = 3$ B1
A statement (mathematical or otherwise) to the effect that
 $x \leq -3/4$ or $3 \leq x$ (or equivalent)
(f.t. candidate's derived critical values) B2
Deduct 1 mark for each of the following errors
the use of strict inequalities
the use of the word 'and' instead of the word 'or'
7. (a) $y + \delta y = 5(x + \delta x)^2 + 8(x + \delta x) - 11$ B1
Subtracting y from above to find δy M1
 $\delta y = 10x\delta x + 5(\delta x)^2 + 8\delta x$ A1
Dividing by δx and letting $\delta x \rightarrow 0$ M1
 $\frac{dy}{dx} = \lim_{\delta x \rightarrow 0} \frac{\delta y}{\delta x} = 10x + 8$ (c.a.o.) A1
- (b) $\frac{dy}{dx} = 6 \times \frac{2}{3} \times x^{-1/3} + 5 \times -2 \times x^{-3}$ (completely correct answer) B2
(If B2 not awarded, award B1 for at least one correct non-zero term)
8. Attempting to find $f(r) = 0$ for some value of r M1
 $f(-1) = 0 \Rightarrow x + 1$ is a factor A1
 $f(x) = (x + 1)(8x^2 + ax + b)$ with one of a, b correct M1
 $f(x) = (x + 1)(8x^2 - 10x + 3)$ A1
 $f(x) = (x + 1)(2x - 1)(4x - 3)$ (f.t. only $8x^2 + 10x + 3$ in above line) A1
 $x = -1, 1/2, 3/4$ (f.t. for factors $2x \pm 1, 4x \pm 3$) A1

9. (a)



down curve with y -coordinate of maximum = 4
 x -coordinate of maximum = -3
 Both points of intersection with x -axis

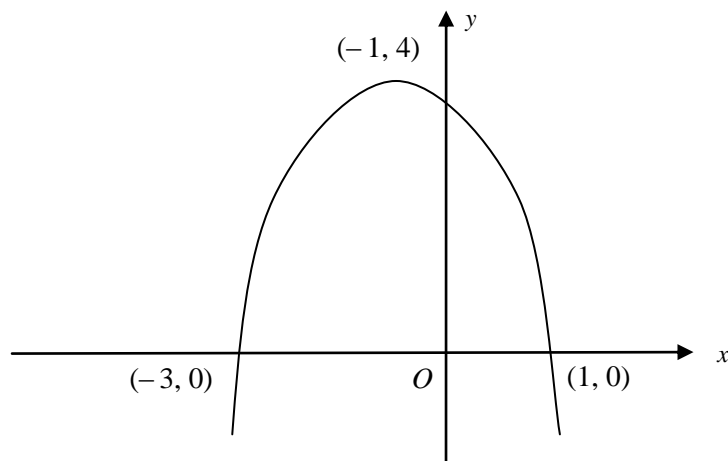
B1

B1

B1

Concave

(b)



Concave down curve with y -coordinate of maximum = 4
 x -coordinate of maximum = -1
 Both points of intersection with x -axis

B1

B1

B1

Note: A candidate who draws a curve with no changes to the original graph is awarded 0 marks (both parts)

10. (a) (i) $(2x \times x) + (2x \times x) + (2x \times y) + (2x \times y) + (x \times y) + (x \times y)$
 $= 108$ M1
 $6xy + 4x^2 = 108 \Rightarrow xy = 18 - \frac{2x^2}{3}$ (convincing) A1
- (ii) $V = 2x \times x \times y = 2x(xy) \Rightarrow V = 36x - \frac{4x^3}{3}$ (convincing) B1
- (b) $\frac{dV}{dx} = 36 - 3 \times \frac{4x^2}{3}$ B1
 Putting derived $\frac{dV}{dx} = 0$ M1
 $x = 3, (-3)$ (f.t. candidate's $\frac{dV}{dx}$) A1
 Stationary value of V at $x = 3$ is 72 (c.a.o) A1
 A correct method for finding nature of the stationary point yielding a maximum value (for $0 < x$) B1