

Question number	Scheme	Marks
<p><b>1.</b> (a)</p> <p>(b)</p>	$\log_q 16 = \log_q 2^4, \therefore p = 4\log_q 2 \quad \text{i.e. } \log_q 2 = \frac{p}{4}$ $\log_q (8_q) = \log_q 8 + \log_q q$ $= \dots + 1$ $= 3 \log_q 2 + \dots$ $\therefore \log_q (8_q) = \frac{3}{4}p + 1$	<p>M1, A1 (2)</p> <p>M1</p> <p>B1</p> <p>M1</p> <p>A1 (4)</p> <p><b>(6 marks)</b></p>
<p><b>2.</b> (a)</p> <p>(b)</p> <p>(c)</p>	$64 - 16 - 28 + c = 0 \quad c = -20$ $(x - 4)(x^2 + 3x + 5)$ <p>For <math>x^2 + 3x + 5</math>, <math>b^2 - 4ac = -11 &lt; 0</math>, <math>\therefore</math> No real roots</p>	<p>M1 A1 (2)</p> <p>B1 M1 A1 (3)</p> <p>M1 A1 ft (2)</p> <p><b>(7 marks)</b></p>
<p><b>3.</b> (a)</p>	$2\sin^2 \theta - 2 \sin \theta = 1 - \sin^2 \theta$ $3\sin^2 \theta - 2 \sin \theta - 1 = 0$ $(3\sin \theta + 1)(\sin \theta - 1) = 0$ $\sin \theta = -\frac{1}{3} \quad \sin \theta = 1$ $\theta = -19.5^\circ - 160.5^\circ \quad 90^\circ$	<p>M1</p> <p>A1</p> <p>M1 A1ft</p> <p>A1</p> <p>A1 A1ft A1 (8)</p> <p><b>(8 marks)</b></p>
<p><b>4.</b> (a)</p> <p>(b)</p> <p>(c)</p>	<p>Attempting to get to <math>a^6 =</math> from <math>800 = \frac{2000a^6}{4+a^6}</math></p> $a^6 = \frac{3200}{1200}$ $a = \left(\frac{3200}{1200}\right)^{\frac{1}{6}} \rightarrow 1.1776$ <p>Substituting <math>P = 1800</math> into formula with <math>a^t</math> as unknown</p> $a^t = 36 \rightarrow, t = 22$ <p>Number of years needed for <math>P</math> from 800 to 1800 = 16 years</p> $P = \frac{2000}{1+4a^{-t}}, 4a^{-t} \rightarrow 0 \text{ as } t \rightarrow \infty$ <p>So <math>P \rightarrow 2000</math> but does not exceed it</p>	<p>M1</p> <p>A1</p> <p>M1 A1 cao (4)</p> <p>M1</p> <p>A1 M1</p> <p>A1 ft (4)</p> <p>B1 (1)</p> <p><b>(9 marks)</b></p>

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<p><b>5.</b> (a)</p>	<p>Expanding using coefficients 1, 5, 10, 10, 5, 1 as necessary</p> <p>Using powers <math>x^5</math> <math>2x^4</math> <math>2^2x^3</math> etc as necessary</p> <p>Completing the method</p> <p><math>A = 64</math></p> <p><math>B = 160, C = 20</math></p>	<p>M1</p> <p>M1</p> <p>M1</p> <p>B1</p> <p>A2,1,0 (6)</p>
<p>(b)</p>	<p>Candidate values of <math>A, B, C</math> used to form</p> <p><math>20x^4 + 160x^2 + 64 = 349</math></p> <p><math>4y^2 = 32y - 57 = 0</math></p> <p>Solving for <math>y</math></p> <p>Replacing by <math>x^2</math> and completing to obtain all relevant values of <math>x</math></p> <p><math>\pm \sqrt{\frac{3}{2}}</math> or AWRT <math>\pm 1.22</math></p>	<p>M1</p> <p>A1 ft</p> <p>M1</p> <p>M1</p> <p>A1 cao (5)</p> <p><b>(11 marks)</b></p>
<p><b>6.</b> (a)</p>	<p><math>\frac{1}{2} R^2 \theta = \frac{49}{2} \theta</math> or <math>\frac{1}{2} r^2 \theta = \frac{25}{2} \theta</math></p> <p><math>\frac{1}{2} R^2 \theta - \frac{1}{2} r^2 \theta = \frac{49}{2} \theta - \frac{25}{2} \theta = 12\theta</math></p>	<p>B1</p> <p>M1 A1 (3)</p>
<p>(b)</p>	<p><math>12\theta = 15</math> <math>\theta = 1.25</math> *</p>	<p>M1 A1 (2)</p>
<p>(c)</p>	<p><math>R\theta = 7 \times 1.25</math> (or <math>r\theta = 5 \times 1.25</math>)</p> <p><math>R\theta + r\theta + 4 = 8.75 + 6.25 + 4 = 19</math> m</p>	<p>B1</p> <p>M1 A1 (3)</p>
<p>(d)</p>	<p><math>\sin 0.625 = \frac{x}{5}</math> <math>AD = 2x</math> (= 5.851 m)</p> <p><math>6.25 - 5.85 = 0.399</math> 40m</p>	<p>M1</p> <p>M1 A1 (3)</p> <p><b>(11 marks)</b></p>

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7. (a)	$S = a + ar + ar^2 + \dots + ar^{n-1}$ $rS = ar + ar^2 + \dots + ar^n$ <p>Subtract: <math>S(1-r) = a(1-r^n)</math>      <math>S = \frac{a(1-r^n)}{1-r}</math></p>	B1 M1 M1 A1      (4)
7. (b)	$ar = 3$ $ar^3 = 1.08$ <p>Divide: <math>r^2 = 0.36</math>      <math>r = 0.6</math></p> $a = 6 \div 1.2 = 5$	B1 B1 M1 A1 A1      (5)
7. (c)	$S = \frac{5}{1-0.6}$ $= 12.5$	M1 A1 ft A1      (3) <b>(12 marks)</b>
8. (a)	$y = x(x^2 - 6x + 9) = (x-3)^2, *$ $A(3, 0)$	B1, B1      (2)
8. (b)	$\frac{dy}{dx} = 3x^2 - 12x + 9$ $3(x^2 - 4x + 3) = 0$ $3(x-1)(x-3) = 0$ <p>At B,      <math>x = 1</math>    <math>y = 4</math>      (1,4)</p>	M1 A1 M1 A1 A1      (5)
8. (c)	$\int (x^3 - 6x^2 + 9x) dx = \frac{1}{4}x^4 - 2x^3 + \frac{9}{2}x^2$ $\left[ \frac{1}{4}x^4 - 2x^3 + \frac{9}{2}x^2 \right]_3^0 = \frac{81}{4} - 54 + \frac{81}{2} = 6\frac{3}{4}$	M1 A2, 1,0 M1 A1      (5) <b>(12 marks)</b>