

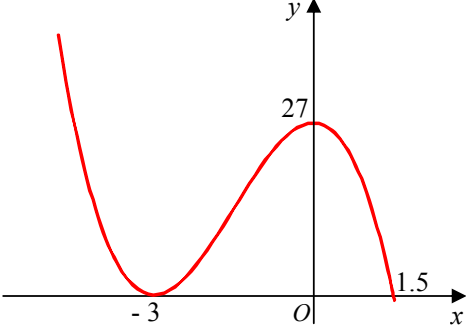
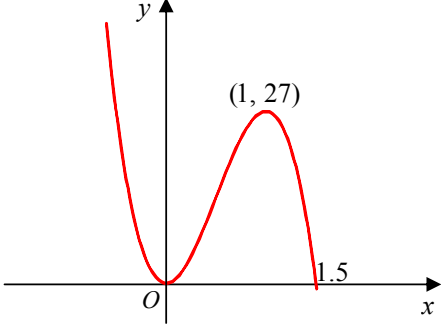
WMA01/01: Core Mathematics C12

Question Number	Scheme	Marks						
<p>1. (a)</p> <p>(b)</p>	<p><math>5x^2</math></p> <p><math>(25x^4)^{-\frac{3}{2}} = \frac{1}{(25x^4)^{\frac{3}{2}}}</math> or <math>(25x^4)^{\frac{3}{2}} = 125x^6</math> or better</p> <p><math>\frac{1}{125x^6}</math></p>	<p>B1 (1)</p> <p>M1</p> <p>A1 (2)</p> <p><b>(3 marks)</b></p>						
<p>2.</p>	<p><math>(3-x)^6 = 3^6 + 3^5 \times 6 \times (-x) + 3^4 \times \binom{6}{2} \times (-x)^2</math></p> <p><math>= 729, \quad -1458x, \quad +1215x^2</math></p>	<p>M1</p> <p>B1, A1, A1 (4 marks)</p>						
<p>3. (i)</p> <p>(ii)</p>	<table border="0" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%; vertical-align: top;"> <p><math>(5 - \sqrt{8})(1 + \sqrt{2})</math></p> <p><math>= 5 + 5\sqrt{2} - \sqrt{8} - 4</math></p> <p><math>= 5 + 5\sqrt{2} - 2\sqrt{2} - 4</math></p> <p><math>= 1 + 3\sqrt{2}</math></p> </td> <td style="width: 33%; vertical-align: top; border-left: 1px solid black; border-right: 1px solid black;"> <p style="text-align: center;">Multiplies out brackets correctly.</p> <p style="text-align: center;"><math>\sqrt{8} = 2\sqrt{2}</math>, seen or implied at any point.</p> <p style="text-align: center;"><math>1 + 3\sqrt{2}</math> or <math>a = 1</math> and <math>b = 3</math></p> </td> <td style="width: 33%;"></td> </tr> <tr> <td style="vertical-align: top;"> <p style="text-align: center;">Method 1</p> <p><b>Either</b> <math>\sqrt{80} + \frac{30}{\sqrt{5}} \left( \frac{\sqrt{5}}{\sqrt{5}} \right)</math></p> <p><math>= 4\sqrt{5} + \dots</math></p> <p><math>= 4\sqrt{5} + 6\sqrt{5}</math></p> </td> <td style="vertical-align: top; border-left: 1px solid black; border-right: 1px solid black;"> <p style="text-align: center;">Method 2</p> <p><b>Or</b> <math>\left( \frac{\sqrt{400+30}}{\sqrt{5}} \right) \frac{\sqrt{5}}{\sqrt{5}}</math></p> <p><math>= \left( \frac{20+\dots}{\dots} \right) \dots</math></p> <p><math>= \left( \frac{50\sqrt{5}}{5} \right)</math></p> <p><math>= 10\sqrt{5}</math></p> </td> <td style="vertical-align: top;"> <p style="text-align: center;">Method 3</p> <p><math>\sqrt{80} + \frac{\sqrt{900}}{\sqrt{5}} = \sqrt{80} + \sqrt{180}</math></p> <p><math>= 4\sqrt{5} + \dots</math></p> <p><math>= 4\sqrt{5} + 6\sqrt{5}</math></p> </td> </tr> </table> <p>As this is a “show that” question – all working should be shown.</p>	<p><math>(5 - \sqrt{8})(1 + \sqrt{2})</math></p> <p><math>= 5 + 5\sqrt{2} - \sqrt{8} - 4</math></p> <p><math>= 5 + 5\sqrt{2} - 2\sqrt{2} - 4</math></p> <p><math>= 1 + 3\sqrt{2}</math></p>	<p style="text-align: center;">Multiplies out brackets correctly.</p> <p style="text-align: center;"><math>\sqrt{8} = 2\sqrt{2}</math>, seen or implied at any point.</p> <p style="text-align: center;"><math>1 + 3\sqrt{2}</math> or <math>a = 1</math> and <math>b = 3</math></p>		<p style="text-align: center;">Method 1</p> <p><b>Either</b> <math>\sqrt{80} + \frac{30}{\sqrt{5}} \left( \frac{\sqrt{5}}{\sqrt{5}} \right)</math></p> <p><math>= 4\sqrt{5} + \dots</math></p> <p><math>= 4\sqrt{5} + 6\sqrt{5}</math></p>	<p style="text-align: center;">Method 2</p> <p><b>Or</b> <math>\left( \frac{\sqrt{400+30}}{\sqrt{5}} \right) \frac{\sqrt{5}}{\sqrt{5}}</math></p> <p><math>= \left( \frac{20+\dots}{\dots} \right) \dots</math></p> <p><math>= \left( \frac{50\sqrt{5}}{5} \right)</math></p> <p><math>= 10\sqrt{5}</math></p>	<p style="text-align: center;">Method 3</p> <p><math>\sqrt{80} + \frac{\sqrt{900}}{\sqrt{5}} = \sqrt{80} + \sqrt{180}</math></p> <p><math>= 4\sqrt{5} + \dots</math></p> <p><math>= 4\sqrt{5} + 6\sqrt{5}</math></p>	<p>M1</p> <p>B1</p> <p>A1 (3)</p> <p>M1</p> <p>B1</p> <p>A1 (3)</p> <p><b>(6 marks)</b></p>
<p><math>(5 - \sqrt{8})(1 + \sqrt{2})</math></p> <p><math>= 5 + 5\sqrt{2} - \sqrt{8} - 4</math></p> <p><math>= 5 + 5\sqrt{2} - 2\sqrt{2} - 4</math></p> <p><math>= 1 + 3\sqrt{2}</math></p>	<p style="text-align: center;">Multiplies out brackets correctly.</p> <p style="text-align: center;"><math>\sqrt{8} = 2\sqrt{2}</math>, seen or implied at any point.</p> <p style="text-align: center;"><math>1 + 3\sqrt{2}</math> or <math>a = 1</math> and <math>b = 3</math></p>							
<p style="text-align: center;">Method 1</p> <p><b>Either</b> <math>\sqrt{80} + \frac{30}{\sqrt{5}} \left( \frac{\sqrt{5}}{\sqrt{5}} \right)</math></p> <p><math>= 4\sqrt{5} + \dots</math></p> <p><math>= 4\sqrt{5} + 6\sqrt{5}</math></p>	<p style="text-align: center;">Method 2</p> <p><b>Or</b> <math>\left( \frac{\sqrt{400+30}}{\sqrt{5}} \right) \frac{\sqrt{5}}{\sqrt{5}}</math></p> <p><math>= \left( \frac{20+\dots}{\dots} \right) \dots</math></p> <p><math>= \left( \frac{50\sqrt{5}}{5} \right)</math></p> <p><math>= 10\sqrt{5}</math></p>	<p style="text-align: center;">Method 3</p> <p><math>\sqrt{80} + \frac{\sqrt{900}}{\sqrt{5}} = \sqrt{80} + \sqrt{180}</math></p> <p><math>= 4\sqrt{5} + \dots</math></p> <p><math>= 4\sqrt{5} + 6\sqrt{5}</math></p>						

Question Number	Scheme		Marks
<p>4. (a)</p> <p>(b)</p>	$\frac{dy}{dx} = 10x^4 - 3x^{-4} \quad \text{or} \quad 10x^4 - \frac{3}{x^4}$ $\left(\int =\right) \frac{2x^6}{6} + 7x + \frac{x^{-2}}{-2} = \frac{x^6}{3} + 7x - \frac{x^{-2}}{2} + C$		<p>M1 A1 A1 (3)</p> <p>M1 A1 A1 B1 (4) <b>(7 marks)</b></p>
<p>5.</p>	$\frac{1}{2} \times 0.25 ; \times \{ 0.5 + 0.2 + 2(0.379 + 0.299 + 0.242) \}$  $\left\{ = \frac{1}{8}(2.540) \right\} = 0.3175 \text{ or } 0.318$	<p>Outside brackets <math>\frac{1}{2} \times 0.25</math> or <math>\frac{1}{8}</math> For structure of <math>\{ \dots \}</math>; Correct expression <u>inside brackets</u> which all must be multiplied by their “outside constant”. awrt 0.32</p>	<p>B1 aef M1 <u>A1</u> <math>\sqrt{\quad}</math> A1 <b>4 marks</b></p>
<p>6. (a)</p> <p>(b)</p>	<p><math>f(x) = x^4 + x^3 + 2x^2 + ax + b</math></p> <p>Attempting <math>f(1)</math> or <math>f(-1)</math>.  <math>f(1) = 1 + 1 + 2 + a + b = 7</math> or <math>4 + a + b = 7 \Rightarrow a + b = 3</math> (as required) <b>AG</b></p> <p>Attempting <math>f(-2)</math> or <math>f(2)</math>.  <math>f(-2) = 16 - 8 + 8 - 2a + b = -8 \quad \{ \Rightarrow -2a + b = -24 \}</math>                      Solving both equations simultaneously to get as far as <math>a = \dots</math> or <math>b = \dots</math>                      Any one of <math>a = 9</math> or <math>b = -6</math>                      Both <math>a = 9</math> and <math>b = -6</math></p>		<p>M1 A1 * cso (2)</p> <p>M1 A1 dM1 A1 A1 cso (5) <b>(7 marks)</b></p>

WMA01/01: Core Mathematics C12

Question Number	Scheme	Marks
<p>7. (a)</p> <p>(b)</p>	<p><math>(a_2 =) 6 - c</math></p> <p><math>a_3 = 3(\text{their } a_2) - c \quad (= 18 - 4c)</math></p> <p><math>a_1 + a_2 + a_3 = 2 + "(6 - c)" + "(18 - 4c)"</math></p> <p><math>"26 - 5c" = 0</math></p> <p>So <math>c = 5.2</math></p>	<p>B1</p> <p>(1)</p> <p>M1</p> <p>M1</p> <p>A1ft</p> <p>A1 o.e</p> <p>(4)</p> <p><b>(5 marks)</b></p>
<p>8. (a)</p> <p>(b)</p>	<p>Attempts <math>b^2 - 4ac</math> for <math>a = (k + 3)</math>, <math>b = 6</math> and their <math>c</math>. <math>c \neq k</math></p> <p><math>b^2 - 4ac = 6^2 - 4(k + 3)(k - 5)</math></p> <p><math>-4k^2 + 8k + 96</math></p> <p>As <math>b^2 - 4ac &gt; 0</math>, then <math>-4k^2 + 8k + 96 &gt; 0</math> and so, <math>k^2 - 2k - 24 &lt; 0</math></p> <p>Attempts to solve <math>k^2 - 2k - 24 = 0</math> to give <math>k =</math></p> <p>(<math>\Rightarrow</math> Critical values, <math>k = 6, -4.</math>)</p> <p><math>k^2 - 2k - 24 &lt; 0</math> gives <math>-4 &lt; k &lt; 6</math></p>	<p>M1</p> <p>A1</p> <p>B1</p> <p>A1 *</p> <p>(4)</p> <p>M1</p> <p>M1 A1</p> <p>(3)</p> <p><b>(7 marks)</b></p>
<p>9. (a)</p> <p>(b)</p>	<p><math>\log_3 3x^2 = \log_3 3 + \log_3 x^2</math> or <math>\log y - \log x^2 = \log 3</math> or <math>\log y - \log 3 = \log x^2</math></p> <p><math>\log_3 x^2 = 2 \log_3 x</math></p> <p>Using <math>\log_3 3 = 1</math> and deduces answer.</p> <p><math>3x^2 = 28x - 9</math></p> <p>Solves <math>3x^2 - 28x + 9 = 0</math> to give <math>x = \frac{1}{3}</math> or <math>x = 9</math></p>	<p>B1</p> <p>B1</p> <p>B1</p> <p>(3)</p> <p>M1</p> <p>M1 A1</p> <p>(3)</p> <p><b>(6 marks)</b></p>

Question Number	Scheme	Marks
<p>10. (a) (b) i</p>	<p>{Coordinates of A are} (4.5, 0)</p>  <p>Horizontal translation -3 and their ft 1.5 on positive x-axis</p> <p>Maximum at 27 marked on the y-axis</p>	<p>B1 M1 A1 ft B1 (3)</p>
<p>(b) ii</p>	 <p>Correct shape, minimum at (0, 0) and a maximum within the first quadrant.</p> <p>1.5 on x-axis</p> <p>Maximum at (1, 27)</p>	<p>M1 A1 ft B1 (3)</p>
<p>(c)</p>	<p>{k =} -17</p>	<p>B1 (1) <b>(8 marks)</b></p>

Question Number	Scheme	Marks
<p><b>11. (a)</b></p>	<p>Curve: <math>y = -x^2 + 2x + 24</math>, Line: <math>y = x + 4</math>                      {Curve = Line} <math>\Rightarrow -x^2 + 2x + 24 = x + 4</math>  <math>x^2 - x - 20 \{= 0\} \Rightarrow (x - 5)(x + 4) \{= 0\} \Rightarrow x = \dots</math>                      So, <math>x = 5, -4</math>                      So corresponding <math>y</math>-values are <math>y = 9</math> and <math>y = 0</math></p>	<p>Eliminating <math>y</math> correctly. B1                      Attempt to solve a <b>resulting</b> quadratic to give <math>x =</math> their values. M1                      Both <math>x = 5</math> and <math>x = -4</math> A1                      B1ft (4)</p>
<p><b>(b)</b></p>	<p><math>\left\{ \int (-x^2 + 2x + 24) dx \right\} = -\frac{x^3}{3} + \frac{2x^2}{2} + 24x \{+ c\}</math>  <math>\left[ -\frac{x^3}{3} + \frac{2x^2}{2} + 24x \right]_{-4}^5 = (\dots) - (\dots)</math>  <math>\left\{ \left( -\frac{125}{3} + 25 + 120 \right) - \left( \frac{64}{3} + 16 - 96 \right) \right\} = \left( 103\frac{1}{3} \right) - \left( -58\frac{2}{3} \right) = 162</math>                      Area of <math>\Delta = \frac{1}{2}(9)(9) = 40.5</math> Uses correct method for finding area of triangle.                      So area of <math>R</math> is <math>162 - 40.5 = 121.5</math> Area under curve – Area of triangle. 121.5</p>	<p>M1: <math>x^n \rightarrow x^{n+1}</math> for any one term. M1 A1 A1                      1<sup>st</sup> A1 at least two out of three terms correct.                      2<sup>nd</sup> A1 for <u>correct answer</u>.                      Substitutes 5 and <math>-4</math> (or their limits from part (a)) into an “integrated function” and subtracts, either way round. dM1                      M1                      M1                      A1 oe <b>cao</b> (7)  <b>(11 marks)</b></p>

Question Number	Scheme	Marks
12. (a)	$(10 - 2)^2 + (7 - 1)^2$ or $\sqrt{(10 - 2)^2 + (7 - 1)^2}$ $(x \pm 2)^2 + (y \pm 1)^2 = k$ ( $k$ a positive <u>value</u> ) $(x - 2)^2 + (y - 1)^2 = 100$ (Accept $10^2$ for 100) (Answer only scores full marks)	M1 A1 M1 A1 (4)
12. (b)	(Gradient of radius $\Rightarrow \frac{7-1}{10-2} = \frac{6}{8}$ (or equiv.) Must be seen in part (b) Gradient of tangent $= \frac{-4}{3}$ (Using perpendicular gradient method) $y - 7 = m(x - 10)$ $y - 7 = \frac{-4}{3}(x - 10)$ or equivalent (ft gradient of <u>radius</u> , dep. on <u>both</u> M marks)	B1 M1 M1 A1ft (4)
12. (c)	$\sqrt{r^2 - \left(\frac{r}{2}\right)^2}$ Condone sign slip if there is evidence of correct use of Pythag. $= \sqrt{10^2 - 5^2}$ or numerically exact equivalent. $PQ (= 2\sqrt{75}) = 10\sqrt{3}$ Simplest surd form $10\sqrt{3}$ required for final mark.	M1 A1 A1 (3) <b>(11 marks)</b>

Question Number	Scheme	Marks
<p><b>13. (a)</b></p>	$kr^2 + cxy = 4 \quad \text{or} \quad kr^2 + c[(x + y)^2 - x^2 - y^2] = 4$ $\frac{1}{4}\pi x^2 + 2xy = 4$ $y = \frac{4 - \frac{1}{4}\pi x^2}{2x} = \frac{16 - \pi x^2}{8x} \quad *$	<p>M1 A1 B1 cso (3)</p>
<p><b>(b)</b></p>	<p><math>P = 2x + cy + k\pi r</math> where <math>c = 2</math> or <math>4</math> and <math>k = \frac{1}{4}</math> or <math>\frac{1}{2}</math></p> $P = \frac{\pi x}{2} + 2x + 4\left(\frac{4 - \frac{1}{4}\pi x^2}{2x}\right) \text{ or } P = \frac{\pi x}{2} + 2x + 4\left(\frac{16 - \pi x^2}{8x}\right) \text{ o.e.}$ $P = \frac{\pi x}{2} + 2x + \frac{8}{x} - \frac{\pi x}{2} \quad \text{so} \quad P = \frac{8}{x} + 2x \quad *$	<p>M1 A1 A1 (3)</p>
<p><b>(c)</b></p>	$\left(\frac{dP}{dx}\right) = -\frac{8}{x^2} + 2$ $-\frac{8}{x^2} + 2 = 0 \Rightarrow x^2 = ..$ <p>and so <math>x = 2</math> o.e. (ignore extra answer <math>x = -2</math>)</p> $P = 4 + 4 = 8 \text{ (m)}$	<p>M1 A1 M1 A1 B1 (5) <b>(11 marks)</b></p>

Question Number	Scheme	Marks
<p><b>14. (a)</b></p>	$\sin(x + 45^\circ) = \frac{2}{3}, \text{ so } (x + 45^\circ) = 41.8103\dots \quad (\alpha = 41.8103\dots)$ $\text{So, } x + 45^\circ = \{138.1897\dots, 401.8103\dots\}$ $\text{and } x = \{93.1897\dots, 356.8103\dots\}$	$\sin^{-1}\left(\frac{2}{3}\right) \text{ or}$ $\text{awrt } 41.8 \text{ or}$ $\text{awrt } 0.73^\circ$ <p>M1</p> $x + 45^\circ = \text{either "180 - their } \alpha \text{" or}$ $\text{"360}^\circ + \text{their } \alpha \text{"}$ <p>M1</p> $\text{Either awrt } 93.2^\circ \text{ or awrt } 356.8^\circ$ <p>A1</p> $\text{Both awrt } 93.2^\circ \text{ and awrt } 356.8^\circ$ <p>A1</p> <p style="text-align: right;">(4)</p>
	<p><b>(b)</b></p> $2(1 - \cos^2 x) + 2 = 7 \cos x$ $2 \cos^2 x + 7 \cos x - 4 = 0$ $(2 \cos x - 1)(\cos x + 4) \{= 0\}, \cos x = \dots$ $\cos x = \frac{1}{2}, \{ \cos x = -4 \}$ $\left( \beta = \frac{\pi}{3} \right)$ $x = \frac{\pi}{3} \text{ or } 1.04719\dots^\circ$ $x = \frac{5\pi}{3} \text{ or } 5.23598\dots^\circ$	<p>Applies <math>\sin^2 x = 1 - \cos^2 x</math></p> <p>Correct 3 term, <math>2 \cos^2 x + 7 \cos x - 4 \{= 0\}</math></p> <p>Valid attempt at solving and <math>\cos x = \dots</math></p> $\cos x = \frac{1}{2}$ <p>M1</p> <p>A1 oe</p> <p>M1</p> <p>A1 cso</p> <p>Either <math>\frac{\pi}{3}</math> or awrt <math>1.05^\circ</math></p> <p>Either <math>\frac{5\pi}{3}</math> or awrt <math>5.24^\circ</math> or <math>2\pi - \text{their } \beta</math></p> <p>B1</p> <p>B1 ft</p> <p style="text-align: right;">(6)</p> <p style="text-align: right;"><b>(10 marks)</b></p>



WMA01/01: Core Mathematics C12

Question Number	Scheme	Marks
15. (a)	$9^2 = 4^2 + 6^2 - 2 \times 4 \times 6 \cos \alpha \Rightarrow \cos \alpha = \dots$ $\cos \alpha = \frac{4^2 + 6^2 - 9^2}{2 \times 4 \times 6} \left( = -\frac{29}{48} = -0.604.. \right)$ $\alpha = 2.22 \quad *$ (NB $\alpha = 2.219516005$ )	Correct use of cosine rule leading to a value for $\cos \alpha$ M1  cso (2.22 must be seen here) A1 (2)
(b)	$2\pi - 2.22 (= 4.06366\dots)$ $\frac{1}{2} \times 4^2 \times "4.06"$ 32.5	$2\pi - 2.22$ or awrt 4.06 B1 Correct method for major sector area. Allow $\pi - 2.22$ for the major sector angle. M1 awrt 32.5 A1 (3)
Or (b)	Alternative method: Circle – Minor sector $\pi \times 4^2$ $\pi \times 4^2 - \frac{1}{2} \times 4^2 \times 2.22 = 32.5$ $= 32.5$	Correct expression for circle area. B1 Correct method for circle - minor sector area. M1 awrt 32.5 A1 (3)
(c)	Area of triangle = $\frac{1}{2} \times 4 \times 6 \times \sin 2.22 (= 9.56)$ So area required = "9.56" + "32.5" $= 42.1 \text{ cm}^2$ or $42.0 \text{ cm}^2$	Correct expression for the area of triangle XYZ B1 Their Triangle XYZ ( <b>Not</b> triangle ZXW) + (part (b) answer or correct attempt at major sector) M1 awrt 42.1 or 42.0 (Or <u>just</u> 42). A1 (3)
(d)	Arc length = $4 \times 4.06 (= 16.24)$ Or $8\pi - 4 \times 2.22$ Perimeter = ZY + WY + Arc Length Perimeter = 27.2 or 27.3	M1: $4 \times \text{their } (2\pi - 2.22)$ M1 A1ft Or circumference – minor arc A1: Correct ft expression $9 + 2 + \text{Any Arc}$ awrt 27.2 or awrt 27.3 A1 (4)
		<b>(12 marks)</b>

WMA01/01: Core Mathematics C12

Question Number	Scheme	Marks
16. (a)	$17 \times 1.5 = 25.5(\text{km})$	B1 (1)
(b)	Use $l = a + (n-1)d$ with $a = 1.5$ , $d = 0.25$ and $n = 17$ So $l = 5.5$	M1 A1 (2)
(c)	Use $S = \frac{a(1-r^n)}{1-r}$ with $a = 1.5$ , and $n = 17$ And $r = 1.05$ So $S = 38.76(\text{km})$	M1 A1 A1 (3)
(d)	Total distance running is $S = \frac{n}{2} \{2a + (n-1)d\}$ $= 59.5(\text{km})$ So total in three sports is $123.76(\text{km})$	M1 A1 B1 (3)
(e)	Uses $ar^{n-1} > 40$ so $1.5 \times (1.05)^{n-1} > 40$ with their $r$ $(1.05)^{n-1} > 26.7$ so $(n-1)\log 1.05 > \log 26.7$ $n-1 > 67.297$ So 69th day of training.	M1 M1 M1 A1 (4) <b>(13 marks)</b>