

**MARK SCHEME for the October/November 2011 question paper  
for the guidance of teachers**

**0581 MATHEMATICS**

**0581/42**

Paper 4 (Extended), maximum raw mark 130

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**Abbreviations**

- cao correct answer only
- cso correct solution only
- dep dependent
- ft follow through after error
- isw ignore subsequent working
- oe or equivalent
- SC Special Case
- www without wrong working
- art anything rounding to
- soi seen or implied

Qu.	Answers	Mark	Part Marks
1	(a) (i) 14.62 final answer	3	M2 for $0.85 \times 20 \times 0.86$ oe soi by 14.6(0) or M1 for $0.85 \times 20$ soi by 17 or $0.85 \times 0.86$ soi by 0.731
	(ii) 20 www	3	M2 for $16.40 / 0.82$ oe or M1 for 16.40 associated with 82%
	(iii) 135 www	2	M1 for $(108 \times 5) / 4$
	(b) $c + 4d = 27.10$ oe $c + 7d = 34.30$ oe Elimination of one variable	B1 B1 M1	Could use other variables but must be consistent  M1 for correct elimination of one variable from their equations – condone 1 arithmetic slip
	(c =) 17.5(0) and (d =) 2.4(0)	A1	Correct answers from no working scores SC1 only
	(c) 36 cao	3	B1 for 7h 30 min or 7.5 or 450 (mins) seen and M1 for $270/t$ where $7 \leq t \leq 9$
	(d) 606.744 or 606.74 or 606.7(0) or 607	2	M1 for $540 \times (1.06)^2$ oe but not $(1 + 6\%)^2$ unless recovers For step by step method, must see 572.4(0) and a correct method for the second year M0 if any further addition or subtraction

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<p>2</p>	<p>(a) (i) 39</p> <p>(ii) <math>\frac{8}{x} + 2</math> or <math>\frac{8+2x}{x}</math> or <math>\frac{2(4+x)}{x}</math> or <math>8x^{-1} + 2</math> final answer</p> <p>(b) -2.5 oe</p> <p>(c) 2.2 oe</p> <p>(d) (i) <math>4x - 2 = \frac{2}{x} + 1</math></p> <p>At least 1 intermediate step and <math>4x^2 - 3x - 2 = 0</math></p> <p>(ii) <math>\frac{-(-3) \pm \sqrt{(-3)^2 - 4(4)(-2)}}{2(4)}</math></p> <p>1.18 and -0.43 cao</p>	<p>2 B1 for (f(2) =) 6 or <math>6^2</math> seen or <math>(4x - 2)^2 + 3</math></p> <p>2 M1 for <math>4\left(\frac{2}{x} + 1\right) - 2</math></p> <p>2 M1 for <math>2 + x = 0.2x</math> oe or <math>\frac{2}{x} = 0.2 - 1</math> or better</p> <p>2 M1 for <math>\frac{2}{5/3} + 1</math> allow 1.66 to 1.67 for 5/3 or <math>\frac{2}{2/x} + 1</math></p> <p>oe with these four terms</p> <p>E1 No errors</p> <p>B1 B1 for <math>\sqrt{(-3)^2 - 4(4)(-2)}</math> or better (41) and in form <math>\frac{p + \sqrt{q}}{r}</math> or <math>\frac{p - \sqrt{q}}{r}</math></p> <p>B1 for <math>-(-3)</math> and <math>2(4)</math> or better</p> <p>B1B1 SC1 for 1.18 and -0.43 seen or 1.2 <u>and</u> -0.4 or 1.17... <u>and</u> -0.425...</p>
<p>3</p>	<p>(a) Reflection only <math>x = -1</math> oe only</p> <p>(b) (i) Triangle (-1, 2) (-1, 6) (-3, 6)</p> <p>(ii) Triangle (-1, -2) (-1, -6) (-3, -6)</p> <p>(iii) Triangle (1, -1) (7, -1) (7, 2)</p> <p>(c) (i) Triangle drawn at (2, 3) (6, 7) (6, 9)</p> <p>(ii) Shear (only) y axis invariant (factor) 1</p> <p>(d) <math>\begin{pmatrix} 0 &amp; 1 \\ -1 &amp; 0 \end{pmatrix}</math></p>	<p>B1 Two transformations scores 0</p> <p>B1</p> <p>B2 B1 for vertices plotted only or for clockwise rotation about (0,0)</p> <p>B2 B1 for vertices plotted only or for reflection in <math>x = y</math></p> <p>B2 B1 for vertices plotted only or for enlargement by 1.5 with correct orientation</p> <p>3 B2 for 2 correct vertices plotted or SC2 for 3 correct coordinates shown in working or SC1 for any 2 correct coordinates</p> <p>or M1 for <math>\begin{pmatrix} 1 &amp; 0 \\ 1 &amp; 1 \end{pmatrix} \begin{pmatrix} 2 &amp; 6 &amp; 6 \\ 1 &amp; 1 &amp; 3 \end{pmatrix}</math></p> <p>B1 Two transformations scores 0</p> <p>B1 or <math>x = 0</math> invariant</p> <p>B1</p> <p>B2 B1 for either column or row correct</p>

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<p><b>4</b></p>	<p>(a) (i) 28 cao</p> <p>(ii) 420</p> <p>(b) <math>(r^3 =) \frac{3 \times 1080}{4\pi}</math> oe</p> <p><math>(r =) \sqrt[3]{\frac{3 \times 1080}{4\pi}}</math> oe</p> <p>6.36 or 6.37 www</p> <p>(c) (i) 24</p> <p>(ii) 232 (231.6 to 232.2)</p>	<p><b>2</b></p> <p><b>2ft</b></p> <p><b>M1</b></p> <p><b>M1dep</b></p> <p><b>A1</b></p> <p><b>B1</b></p> <p><b>3</b></p>	<p><b>M1</b> for <math>\frac{350 \times 16}{200}</math> oe or <math>350 \div 12.5</math> oe or <math>1.75 \times 16</math> oe</p> <p>ft for <i>their</i> <math>28 \times 15</math></p> <p><b>M1</b> for <i>their</i> <math>28 \times \frac{240}{16}</math> or <math>\frac{350 \times 240}{200}</math> oe or <math>1.75 \times 240</math> oe</p> <p>Correct rearrangement soi by 257 to 258</p> <p>Dependent on previous <b>M1</b></p> <p>6.364 to 6.366</p> <p><b>M1</b> for <math>\pi \times 2.5^2 \times 1.8</math> (soi by 35.3 to 35.4) or area = <math>20 \times 30 - \text{their } 24 \times \pi \times 2.5^2</math> (soi by 128.7 to 129) and <b>M1dep</b> for <math>1080 - (\pi \times 2.5^2 \times 1.8) \times \text{their } 24</math> or their area <math>\times 1.8</math></p>
<p><b>5</b></p>	<p>(a) 63.45 or 63.5 cso</p> <p>(b) (i) 75 117 195 200</p> <p>(ii) 8 correct points plotted</p> <p>Curve (or polygon) correct through 8 points</p> <p>(c) (i) 65 to 67</p> <p>(ii) 52 to 55</p> <p>(iii) 21 to 24</p> <p>(iv) 44 to 52</p> <p>(v) Integer value of 200 – reading at 45 secs</p>	<p><b>4</b></p> <p><b>B2</b></p> <p><b>P3ft</b></p> <p><b>C1ft</b></p> <p><b>B1ft</b></p> <p><b>B1</b></p> <p><b>B1</b></p> <p><b>B1</b></p> <p><b>2ft</b></p>	<p><b>M1</b> for 10, 30, 45, 55, 65, 75, 85, 95 At least 6 correct mid-values soi and <b>M1</b> for <math>\sum fx</math> (<math>6 \times 10 + 12 \times 30 + 20 \times 45 + \dots + 5 \times 95</math>) (12690) where <math>x</math> is in the correct interval allow one further slip and <b>M1</b> for their <math>\sum fx \div 200</math> dep on second <b>M1</b></p> <p><b>B1</b> for 2 or 3 correct</p> <p><b>P2ft</b> for 6 or 7 <b>P1ft</b> for 4 or 5</p> <p>ft their increasing curve only if at least <b>B1</b> in (b)(i). Ignore <math>t = 0</math> to 20</p> <p>Or ft their curve at cf = 100</p> <p>Must be integer</p> <p><b>B1ft</b> for integer value of reading at 45 secs</p>

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6	<p>(a) (i) 141 (141.3 to 141.4)</p> <p>(ii) 8.93 (8.93...)</p> <p>(b) (i) 2.98 or 2.976 to 2.977</p> <p>(ii) Answer rounds to 15.7</p> <p>(c) 535 or 536 (534.9 to 535.8)</p>	<p>2</p> <p>3</p> <p>2ft</p> <p>2ft</p> <p>5</p>	<p>M1 for <math>\pi \times 4.5 \times 10</math></p> <p>M2 for <math>\sqrt{10^2 - 4.5^2}</math> or M1 for <math>h^2 + 4.5^2 = 10^2</math> implied by 79.75</p> <p>ft their (a)(ii) <math>\div 3</math> www correct to 3sf or better M1 for their (a)(ii) <math>\div 3</math></p> <p>ft their (a)(i) <math>\div 9</math> correct to 3 sf or better or <math>\pi \times 1.5 \times \sqrt{\text{their } 2.98^2 + 1.5^2}</math></p> <p>M1 for their (a)(i) <math>\div 9</math> or <math>\pi \times 1.5 \times 10 \div 3</math> oe or <math>\pi \times 1.5 \times \sqrt{\text{their } 2.98^2 + 1.5^2}</math></p> <p>M1 for area of one circle <math>\pi \times 1.5^2</math> or <math>\pi \times 4.5^2</math> (7.0685 or 63.617) and M1 for their (a)(i) – their (b)(ii) (large cone SA – small cone SA) (141 – 15.7) (= 125.3 to 125.7) and M1 for <math>12 \times \pi \times 9</math> (curved area of cylinder) (339.292..) and M1 for correct collection of 4 areas</p>
7	<p>(a) 8.7, –3.2, –10</p> <p>(b) 6 correct points plotted Smooth curve through 6 points and correct shape</p> <p>(c) Ruled tangent drawn at <math>x = 2</math> Rise/run (using correct scales) 3.4 to 4</p> <p>(d) <math>k &gt; 1.85</math> or <math>k &gt;</math> any value greater than 1.85</p> <p>(e) (i) Correct ruled line for <math>-3 \leq x \leq 3</math></p> <p>(ii) –1.75 to –1.9</p> <p>(f) (i) <math>x^2 + \frac{1}{x} = x + 2</math></p> <p>(ii) <math>(y =) x + 2</math></p>	<p>B3</p> <p>P2ft</p> <p>C1ft</p> <p>T1</p> <p>M1</p> <p>A1</p> <p>B1</p> <p>B2</p> <p>B1</p> <p>B2</p> <p>B1ft</p>	<p>8.66(..) or 8.67, –3.24, –9.99 if given to 2 dp B1 for each correct value</p> <p>P1ft for 5 or 4 correct</p> <p>C0 if curve crosses y-axis</p> <p>Not chord, allow slight daylight</p> <p>Dep T1</p> <p>Accept <math>\geq</math> Ignore <math>k &lt;</math> any value greater than 1.85</p> <p>SC1 for short ruled line or good freehand complete line or any ruled line grad –1 or ruled with y intercept of 1 (not <math>y = 1</math>)</p> <p>B1</p> <p>B1 for <math>x^2 - x - 2 + \frac{1}{x} = 0</math> oe seen or <math>1 + x^3 = x^2 + 2x</math> seen</p> <p>or their <math>ax + b</math> numerical <math>a \neq 0</math> and <math>b \neq 0</math></p>

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8	(a) (i) $3^2 + 5^2 - 2 \times 3 \times 5 \cos 45$ 3.575... or 3.576 cao	M2	M1 for correct implicit version
	(ii) 36.3 to 36.4	E2	A1 for 12.78 to 12.8
		3	M2 for $(\sin BCA =) \frac{3 \times \sin 45}{\text{their } 3.58}$ or M1 for $\frac{\sin BCA}{3} = \frac{\sin 45}{\text{their } 3.58}$ oe
	(b) (i) 76	B1	
	(ii) 17.4 or 17.42 to 17.44	3	M2 for $0.5 \times 3 \times 5 \times \sin 45 + 0.5 \times 5 \times 5 \sin$ their (b)(i) 5.3033... + 12.1286... or M1 for $0.5 \times 3 \times 5 \times \sin 45$ or $0.5 \times 5 \times 5 \sin$ their (b)(i)
	(c) 48.2 (48.18 to 48.19)	2	M1 for $\cos PAB = \frac{2}{3}$ oe

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9	(a) (i) $\frac{120}{336}$ oe $\frac{5}{14}$ 0.357(1...)	3	Accept fraction, %, dec equivalents (3sf or more) throughout but not ratio or words isw incorrect cancelling/conversion to other forms Pen –1 once for 2sf answers M2 for $\frac{6}{8} \times \frac{5}{7} \times \frac{4}{6}$ or M1 for $\frac{5}{7}$ seen
	(ii) $\frac{180}{336}$ oe $\frac{15}{28}$ 0.536 or 0.5357...	3	M2 for $\frac{2}{8} \times \frac{6}{7} \times \frac{5}{6} + \frac{6}{8} \times \frac{2}{7} \times \frac{5}{6} + \frac{6}{8} \times \frac{5}{7} \times \frac{2}{6}$ Accept $3 \times \frac{2 \times 5 \times 6}{6 \times 7 \times 8}$ or M1 for $\frac{2 \times 5 \times 6}{6 \times 7 \times 8}$ oe seen ( $\frac{60}{336}$ oe $\frac{5}{28}$ )
	(b) (i) $\frac{x}{25} \times \frac{x-1}{24} = \frac{7}{100}$ $\frac{x^2 - x}{600} = \frac{7}{100}$ or $x(x-1) = \frac{7}{100} \times 25 \times 24$ $x^2 - x - 42 = 0$	M2	M1 for $\frac{x}{25}$ or $\frac{x-1}{24}$ seen
	(ii) $(x+6)(x-7)$ (iii) -6, 7 (iv) 18	M1 E1 B2 B1ft B1ft	Or better, min requirement is $x^2 - x = 7 \times 6$ With no errors or omissions SC1 any other $(x+a)(x+b)$ where $a \times b = -42$ or $a + b = -1$ Correct or follow through dep on at least SC1 in (b)(ii) Correct or ft 25 – their positive integer solution Dep on pos and neg answer to (b)(iii) Answer must be positive integer