

**MARK SCHEME for the October/November 2009 question paper  
for the guidance of teachers**

**0580 MATHEMATICS**

**0580/04**

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
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
soi	seen or implied
www	without wrong working

1 (a) (i)	8.4(0)	B2	B1 for 1.2 or 3.6 seen or SC1 for figs 84 in answer
(ii)	$\frac{\text{their}(i)}{20} \times 100$ oe 42 ft www2	M1 A1ft	ft their $8.4 \times 5$ After 0 scored SC1 ft for 58% or $\frac{20 - \text{their}(i)}{20} \times 100$ correctly given
(b)	6	B2	M1 for $9$ or $8 \div (1 + 8 + 3)$ soi
(c)	$\frac{2.4}{2} \times 3$ oe (= 3.6 seen) or their (a) (i) $\div 7 \times 3$  $\frac{3}{12} \times 9$ oe (= 2.25 seen) 1.6(0) cao www3	M1  M1 A1	
(d)	$\frac{2.40}{1.25}$ oe 1.92 www2	M1 A1	Implied by figs 192   [11]

2 (a) (i)	Reflection (M), $x = 1$	B1,B1	If extra transformations given in part (a) then zero scored
(ii)	Rotation (R) 180 (centre) (1, 0)	B1 B1 B1	Must be "rotation". Allow half turn for 180. Allow other clear forms of (1, 0)
(iii)	Enlargement (E) (centre) (6, 4) (scale factor) 3	B1 B1 B1	Must be "enlargement" Allow other clear forms of (6, 4) e.g. vector Accept 3 : 1 or 1 : 3
(iv)	Shear (H) y-axis invariant oe  (factor) -1	B1 B1  B1	Must be "shear" Allow other explanation for invariant but not "parallel to" isw after y-axis invariant seen

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(b) (i)	$\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$	B2	B1 for correct right-hand column in 2 by 2 matrix
(ii)	$\begin{pmatrix} 1 & 0 \\ -1ft & 1 \end{pmatrix}$	B2ft	Ft only their factor in (a) (iv) provided not zero B1ft for left-hand column in 2 by 2 matrix provided shear factor is not zero or SC1 for $\begin{pmatrix} 1 & 0 \\ 1 & 1 \end{pmatrix}$ if not ft

[15]

3 (a) (i)	1	B1	Penalty of –1 in question if any answers given as decimals or percentages (to 3sf) alone, but isw cancelling/conversion after correct answer
(ii)	$\frac{3}{6}$ oe	B1	
(b) (i)	$\frac{2}{30}$ oe www2	B2	M1 for $\frac{2}{6} \times \frac{1}{5}$
(ii)	6–12 and 12–6 and 7–11 and 11–7 soi $k \times \frac{1}{6} \times \frac{1}{5}$ for $k = \text{integer}$ $\frac{4}{30}$ oe www3	M1 M1 A1	Evidence of all pairs adding up to 18 but no extras e.g. $4/6 \times 1/6$ Without seeing the first M, $\frac{4}{6} \times \frac{1}{5}$ oe scores M2, $\frac{2}{6} \times \frac{1}{5}$ oe scores M1
(iii)	$\frac{4}{6} \times \frac{2}{5}$ $\frac{8}{30}$ oe www2	M1 A1	
(c)	$\frac{2}{6} + \frac{4}{6} \times \frac{2}{5}$ oe $\frac{18}{30}$ oe cao www2	M1 A1	$\frac{2}{6} + \text{their (b) (iii)}$
(d)	4	B2	M1 for $(1 + 1 + 6 + 7 + 11 + 12 + x) \div 7 = 6$ or better

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4 (a) (i)	Accurate triangle with 2 arcs seen, 2 mm accuracy for lines AC and BC	B2	SC1 if accurate but no arcs or one arc on AC and BC are wrong way round with arcs
(ii)	Accurate bisector of angle ACB, 2° accuracy and both pairs of arcs shown (accept equidistant marks on edges for 1 <sup>st</sup> set of arcs) + must meet AB	B2ft	Ft their triangle SC1ft if accurate but no/one pair of arcs or short with arcs In both (ii) and (iii) isw
(iii)	Accurate perpendicular bisector of AD 2 mm accuracy at mid-point and 2° for right angle and shows both sets of arcs + must meet AC	B2ft	ft their D, which must be on AB SC1ft if accurate but no/one pair of arcs or short with arcs
(iv)	Correct region shaded cao	B1	Dependent on correct triangle, accurate bisectors of angle ACB and side AD with correct D
(b) (i)	$(\cos C) = \frac{140^2 + 180^2 - 240^2}{2 \times 140 \times 180}$ oe  – 0.111(1)...or better or 96.37 to 96.38	M2  E1	(–5600/50400 or –14/126) Allow use of 7, 9 and 12 M1 for correct implicit statement Verification using 96.4 scores M2 max Accept $-\frac{1}{9}$ but not a non-reduced fraction
(ii)	$0.5 \times 140 \times 180 \sin(\text{their } 96.4)$ oe 12521 to 12523 or 12 500 or 12520 cao www2	M1 A1	(s = 280), allow use of 7, 9 (31.3...)
(iii)	$(\sin B) = \frac{140 \sin(\text{their } 96.4)}{240}$ oe  35.4 or 35.42 to 35.44 cao www3	M2  A1	Allow use of 7, 12 M1 for correct implicit statement SC2 for correct answer by other method

[15]

5 (a) (i)	$(x + 3)(2x + 5) - x(x + 4) = 59$ oe $2x^2 + 6x + 5x + 15 - x^2 - 4x = 59$ oe $x^2 + 7x - 44 = 0$	M1 A1 E1	Implies M1 (allow 11x for 6x + 5x) Correct conclusion – no errors or omissions
(ii)	$(x + 11)(x - 4)$	B2	SC1 any other $(x + a)(x + b)$ where $a \times b = -44$ or $a + b = 7$
(iii)	–11, 4 www ft	B1ft	Strict ft dep on at least SC1 in (ii) allow recovery if new working seen
(iv)	$\tan = \frac{(\text{their} + \text{ve root}) + 3}{2(\text{their} + \text{ve root}) + 5}$ oe  28.3 (00...) ft www2	M1 A1ft	Could be alt trig method oe M1 where trig function is explicit ft one of their positive roots (27.4° (27.40 – 27.41) from $x = 11$ )

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(b) (i)	$\frac{2x+5}{x+4} = \frac{x+3}{x}$ oe $x^2 + 4x + 3x + 12 = 2x^2 + 5x$ $x^2 - 2x - 12 = 0$	<b>M1</b> Must be seen. Allow ratio or correct pro <b>A1</b> Correct expansion of brackets seen (allow $7x^2 - 4x + 3x$ ) <b>E1</b> Correct conclusion – no errors or omissions <b>M1</b> must be seen
(ii)	$\frac{-(-2) \pm \sqrt{(-2)^2 - 4(1)(-12)}}{2(1)}$ or $(x-1)^2 - 12 = 1$ (B1) and $x-1 = \pm\sqrt{13}$ (B1) – 2.61, 4.61 final answers www4	<b>B1,B1</b> In square root <b>B1</b> for $(-2)^2 - 4(1)(-12)$ or better If in form $\frac{p+\sqrt{q}}{r}$ or $\frac{p-\sqrt{q}}{r}$ , <b>B1</b> for $-(-2)$ and $2(1)$ or better <b>B1,B1</b> If B0, <b>SC1</b> for –2.6 and 4.6 or both answers correct to 2 or more dps rot – 2.6055..., 4.6055....
(iii)	26.4 (26.42.... to 26.44....) ft	<b>B1ft</b> ft $4 \times$ a positive root + 8 <div style="text-align: right;">[16]</div>

6 (a) (i)	–16	<b>B1</b>	
(ii)	18 to 19	<b>B1</b>	
(b) (i)	–4.3 to –4.2, 1.5 to 1.6	<b>B1,B1</b>	
(ii)	–4.5 to –4.4 , 1.3 to 1.4	<b>B1,B1</b>	
(iii)	–4.5 to –4.4 $< x < 1.3$ to 1.4 ft	<b>B1ft</b>	Ft their (ii). Allow clear worded explanations and condone $\leq$ signs
(c)	$-\frac{30}{7}$ oe isw conversion	<b>B2</b>	Accept $-4\frac{2}{7}$ , 30/–7 <b>M1</b> for 30/7 oe fracts, isw conversion or for –30/7 oe soi
(d)	Ruled line passing within 2 mm of (–5, 30) and (2, 0)	<b>B2</b>	<b>B1</b> for ruled line parallel to $g(x)$ . By eye ( $21^\circ$ to $25^\circ$ to horizontal if in doubt) allow broken line
(e) (i)	Ruled horizontal line through (–3, –27)	<b>B1</b>	No daylight, not chord (allow broken)
(ii)	$y = -27$	<b>B1</b>	
(f)	Ruled lines $x = -3$ , $x = -2$ , $y = 40$ Region enclosed by lines $x = -3$ , $x = -2$ , $y = 40$ and $y = g(x)$	<b>B1</b> <b>B1</b>	Long enough to be boundary of region – allow broken or solid ruled lines Allow any clear indication <div style="text-align: right;">[15]</div>

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7 (a) (i)	$\frac{60}{360} \times \pi \times 2 \times 24$ oe <b>25.1 (25.12 to 25.14)</b> www2	<b>M1</b> <b>A1</b>	Accept $8\pi$
(ii)	$\frac{60}{360} \times \pi \times 24^2$ oe <b>301 or 302 or 301.4 to 301.7</b> www2	<b>M1</b> <b>A1</b>	Accept $96\pi$
(b) (i)	$\pi d = \text{their (a) (i)}$ oe <b>4 (3.99 – 4.01)</b> cao www2	<b>M1</b> <b>A1</b>	
(ii)	$24^2 - (\text{their radius})^2$ <b>23.7 (23.66 to 23.67)</b> cao www2	<b>M1</b> <b>A1</b>	Alt trig method for $h$ explicit Accept $\sqrt{560}, 2\sqrt{140}, 4\sqrt{35}$
(iii)	$\frac{1}{3} \times \pi \times (\text{their } r)^2 \times (\text{their } h)$ <b>394 – 398</b> cao www2	<b>M1</b> <b>A1</b>	Not for $h = 24$
(c) (i)	<b>27W</b>	<b>B1</b>	
(ii)	<b>4W</b>	<b>B1</b>	If B0, B0 in (c), <b>SC1</b> for 27 and 4 alone [12]

8 (a)	<b><math>5.5 &lt; t \leq 6</math></b>	<b>B1</b>	Condone poor notation
(b)	4.25, 4.75, 5.25, 5.75, 6.25, 6.75 $(2 \times 4.25 + 7 \times 4.75 + 8 \times 5.25 + 18 \times 5.75 + 10 \times 6.25 + 5 \times 6.75)$ (= 283.5) $\div 50$ or their $\sum f$ <b>5.67</b> www4	<b>M1</b> <b>M1</b> <b>M1</b> <b>A1</b>	At least 5 correct mid-values seen $\sum fx$ where $x$ is in the correct interval allow one further slip Depend on second method After <b>M3</b> allow 5.7 isw conversion to mins/secs and reference to classes
(c) (i)	<b>17, 15</b>	<b>B1</b>	
(ii)	Rectangular bars of heights <b>11.3</b> and <b>15</b>  Correct widths of 1.5 and 1 – no gaps	<b>B1ft</b> <b>B1ft</b>  <b>B1</b>	ft their 17 divided by 1.5 ft their 15 11.3 plot between 11 and 12 include lines and 15 to be touching the 15 line
(iii)	<b>2.5</b> cao	<b>B1</b>	[10]

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9 (a)	$3(m-3) + 4(m+4) = -7 \times 12$ $3m - 9 + 4m + 16 = -84$ <b>-13</b> www4	<b>M2</b> <b>A1</b> <b>A1</b>	Allow <u>all over</u> 12 at this stage <b>M1</b> for $3(m-3) + 4(m+4)$ seen Allow <u>all over</u> 12 at this stage May be seen in stages
(b) (i)	0.5 oe	<b>B1</b>	
(ii)	$\frac{3(x+3) - 2(x-1)}{(x-1)(x+3)}$ $\frac{x+11}{(x-1)(x+3)}$ final answer	<b>M1</b> <b>A1</b>	If brackets not seen allow $3x + 9 - 2x \pm 2$ as numerator with a correct denominator <b>A1</b> isw incorrect expansion of denominator if correct brackets seen
(iii)	$\frac{x(x+11)}{(x-1)(x+3)} = 1$ ft or $x + 11 = \frac{1}{x} (x-1)(x+3)$ or better ft $x^2 + 11x = x^2 + 3x - x - 3$ $-\frac{1}{3}$ oe cso www3	<b>M1</b> <b>M1</b> <b>A1</b>	Must clear one denominator correctly Ft their <b>(b)(ii)</b> dep on fraction in <b>(ii)</b> with $(x-1)(x+3)$ oe as denominator Depend on previous <b>M1</b> $-0.33(33\dots)$
(c)	$p(q-1) = t$ oe $pq = t + p$ $\frac{t+p}{p}$ oe final answer www3	<b>M1</b> <b>M1</b> <b>M1</b>	Multiplying by $(q-1)$ Ft their first step e.g. $pq$ only term on one side Ft their 2 <sup>nd</sup> step e.g. dividing by $p$ Note: $q-1 = \frac{t}{p}$ is <b>M2</b> and then $q = \frac{t}{p} + 1$ is <b>M1</b> <div style="text-align: right;"><b>[13]</b></div>

10 (a)	$21 + 23 + 25 + 27 + 29 = 125$ $31 + 33 + 35 + 37 + 39 + 41 = 216$	<b>B1</b> <b>B1</b>	
(b)	Cubes	<b>B1</b>	
(c) (i)	$n$ oe	<b>B1</b>	
(ii)	$n^3$ oe	<b>B1</b>	
(d)	$4^2 - 4 + 1 = 13$ www	<b>E1</b>	Allow 16 for $4^2$ , otherwise all must be seen
(e)	$7 \times 43 + 2 + 4 + 6 + 8 + 10 + 12$	<b>B1</b>	All must be seen
(f)	$n(n-1)$ final answer oe	<b>B1</b>	
(g)	$n(n^2 - n + 1)$ + their <b>(f)</b> $n^3 - n^2 + n + n^2 - n = n^3$	<b>M1</b> <b>E1</b>	All must be seen, no errors or omissions <div style="text-align: right;"><b>[10]</b></div>