

MARK SCHEME for the October/November 2012 series

0580 MATHEMATICS

0580/43

Paper 4 (Extended), maximum raw mark 130

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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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) [0]9 15 [am]	1	Any acceptable form of time
	(ii) 64.9 or 65.[0] or 64.92 to 64.98	2	M1 for $92 \div (1 \text{ and } 25 \text{ mins})$ or $92/85 \times 60$ oe or $92 \div (1.41 \text{ to } 1.42)$
	(iii) 11.76...or 11.8	1	
	(iv) 80	3	M2 for $92 \div 1.15$ oe or M1 for 115% associated with 92
	(b) (i) $150 \div (11 + 16 + 3)$ or 150×3 oe then $\times 3$ or $\div 30$	M1	Correct first step
	(ii) 11 : 9 final answer	E1	Correct conclusion
2	(a) (i) Image at $(-3, 1), (-7, 7), (-3, 7)$	2	SC1 for translation $\begin{pmatrix} -11 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ -1 \end{pmatrix}$
	(ii) Image at $(-4, -1), (-4, -4), (-2, -4)$	2	SC1 for enlargement factor 0.5 and correct orientation
	(b) (i) Reflection, $y = 1$	2	In each part of (b) must be one transformation only – if more then lose all marks for that part B1 B1 independent
	(ii) Rotation, $(3, 2), 180$ oe or enlargement, $(3, 2),$ (factor) – 1	3	B1 B1 B1 independent
	(iii) Stretch, (factor) 0.5, Invariant line y -axis or $x = 0$	3	B1 B1 B1 independent – must be clear on invariant line

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	(c) $\begin{pmatrix} 0.5 & 0 \\ 0 & 1 \end{pmatrix}$	2 ft	ft <i>their</i> factor in (b)(iii) only if stretch not 0 or 1 SC1 for $\begin{pmatrix} k & 0 \\ 0 & 1 \end{pmatrix}$ [$k \neq 0$ or 1] or $\begin{pmatrix} 1 & 0 \\ 0 & 0.5 \end{pmatrix}$ ft <i>their</i> factor only if stretch in (b)(iii)
3	(a) 7.407..... or 7.41 (b) 9 (c) (i) 6.36 to 6.37 www (ii) 508 to 510 (d) $\sqrt{2}$ or 1.41 [1.414...] www	1 2 3 2 2	M1 for $1080 \div (12 \times 10)$ oe M2 for $\sqrt[3]{\frac{1080}{\frac{4}{3}\pi}}$ oe or M1 for $\frac{1080}{\frac{4}{3}\pi}$ oe [257.7 to 258.7] Accept 4.18 to 4.19 for $4/3 \pi$ M1 for $4 \times \pi \times (\text{their (c)(i)})^2$ Allow over 1 or $\sqrt{2} : 1$ etc M1 for $(R / r)^2 = 2$ oe or $[R^2 =] (2 \times \text{their (c)(ii)})/4 \pi$ or $[R^2 =] 2 \times (\text{their (c)(i)})^2$
4	(a) 5, – 1 (b) 12 points plotted ft Smooth curve through at least 12 points Two separate branches (c) (i) 0.55 to 0.65 (ii) 0.65 to 0.75 (d) $\frac{1}{3}$	2 P3ft C1 B1 1 2 2	B1 B1 P2ft for 10 or 11, P1ft for 8 or 9 In absence of plot[s], allow curve to imply plot[s]. No ruled sections Not touching y-axis M1 for $y = 3x$ drawn (ruled) to cross curve Accept 0.333[3....] or $0.\dot{3}$ M1 for $\frac{2}{x^2} - 3x = 3x$ or better

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	(e) (i) Ruled line through $(-1, 5)$ and $(3, -9)$ (ii) $y = -3.5x + 1.5$ oe final answer (iii) Tangent	1 3 1	B2 for $y = kx + 1.5$ [$k \neq 0$] oe or $y = -3.5x + d$ oe B1 for gradient = -3.5 oe accept integer/integer or $y = kx + [1.4 \text{ to } 1.6]$ oe SC2 for answer $-3.5x + 1.5$ [no 'y=']
5	(a) 0.57 (b) (i) $\frac{5}{x} + \frac{6}{x+2} = 1$ oe $5(x+2) + 6x = x(x+2)$ oe $5x + 10 + 6x = x^2 + 2x$ oe $0 = x^2 - 9x - 10$ (ii) $(x-10)(x+1)$ (iii) 21	B4 M2 A1 E1 2 2ft	Condone use of other variables M1 for $2w + 3l = 3.6$ oe and M1 for $l = w + 0.25$ oe A1 for correct $aw = b$ or $cl = d$ or M2 for $2w + 3(w + 0.25) = 3.6$ oe or $2(l - 0.25) + 3l = 3.6$ oe or M1 for $w + 0.25$ or $l - 0.25$ seen A1 for $2w + 3w = 3.6 - 0.75$ or better or $2l + 3l = 3.6 + 0.5$ or better $l = 0.82$ implies M2A1 trial & error scores B4 or zero accept answer 57 if written 57 cents after M0, SC3 if answer 57 e.g. $\left(1 - \frac{5}{x}\right)(x+2) = 6$ M1 for $\frac{5}{x}$ seen or $\frac{6}{x+2}$ seen or $xy = 5$ and $(x+2)Y = 6$ oe or $xy = 5$ and $(x+2)(1-y) = 6$ oe e.g. $(x-5)(x+2) = 6x$ Allow $5x + 10 + 6x = x^2 + 2x$ and allow all over correct denominator but must see this line One correctly expanded line seen No errors or omissions SC1 for $(x+a)(x+b)$ where $ab = -10$ or $a+b = -9$ ft a positive x into $2\left(x + \frac{5}{x}\right)$ M1 for 0.5 seen or $5 / \text{their positive root}$

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	(c) (i) $(2x+3)^2 = (x+3)^2 + 5^2$ oe $4x^2 + 6x + 6x + 9 =$ $x^2 + 3x + 3x + 9 + 25$ oe $3x^2 + 6x - 25 = 0$ (ii) $\frac{-6 \pm \sqrt{6^2 - 4(3)(-25)}}{2(3)}$ – 4.06, 2.06 final answer (iii) 12.63 to 12.65 or 12.6 or 12.7	M1 B1 B1 E1 B2 2ft	for $4x^2 + 6x + 6x + 9$ or $4x^2 + 12x + 9$ for $x^2 + 3x + 3x + 9$ or $x^2 + 6x + 9$ No errors or omissions B1 for $\sqrt{6^2 - 4(3)(-25)}$ or better seen If in form $\frac{p + \sqrt{q}}{r}$ or $\frac{p - \sqrt{q}}{r}$ oe B1 for $p = -6$ and $r = 2(3)$ or better B1 B1 After B0 B0 SC1 for – 4.1 and 2.1 or – 4.055... and 2.055... or –4.06 and 2.06 seen ft (a positive $x + 3$) $\times 2.5$ SC1 for $0.5 \times$ <i>their</i> positive value $\times 5$ written
6	(a) $\sin [] = \frac{130}{0.5 \times 16 \times 25}$ oe 40.54... = 40.5 (b) 16.51 to 16.53... or 16.5 www (c) 10.39 to 10.4[0]	M2 E1 4 2	M1 for $0.5 \times 16 \times 25 \times \sin [] = 130$ oe but if 40.54... reached from implicit method then M2 Must see 40.54.. and conclusion Use of 40.5 alone in implicit expression scores M1. M2 for $16^2 + 25^2 - 2 \times 16 \times 25 \times \cos (40.5)$ oe [allow 40.54...] (M1 for $\cos 40.5 = \frac{16^2 + 25^2 - AC^2}{2 \times 16 \times 25}$) [allow 40.54...] A1 for 272.6 to 273.0...(which implies M2) M1 for $0.5 \times 25 \times \text{distance} = 130$ or $\frac{\text{dist}}{16} = \sin[40.5]$ oe [allow 40.54....]

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7	(a) (i) $\frac{2}{20}$ oe	2	Accept fraction, %, dec equivalents [3sf or better] throughout but not in ratio or words Is w incorrect cancelling or converting and do not accept ratios or words Pen –1 once for 2sf answers ft probability if $0 < p < 1$ M1 for $\frac{2}{5} \times \frac{1}{4}$ oe
	(ii) $\frac{6}{20}$ oe	3	M2 for $2 \times \frac{1}{5} \times \frac{1}{4} + 2 \times \frac{2}{5} \times \frac{1}{4}$ oe M1 for pairs 1, 4 and 2, 3 clearly identified and no other incorrect pairings or for one appropriate product is w
	(iii) $\frac{14}{20}$ oe	1ft	ft 1 – <i>their</i> (a)(ii) or recovery to correct ans
	(b) (i) 7	1	
	(ii) 42	1	
	(iii) $\frac{7}{50}$	1ft	ft <i>their</i> 7/50 from Venn diagram or correct recovery
8	(iv) $\frac{7}{9}$ [0.777[7].. or 0.778]	1ft	ft <i>their</i> 7/ <i>their</i> 9 from Venn diagram or correct recovery
	(a) 24	3	M2 for 24 at B or 128 at X and 28 at D. or M1 for 28 at D or 128 at X allow on diagram
	(b) 5 www	3	M2 for $360 - 22x = 2 \times 25x$ oe or better or $22x = 2(180 - 25x)$ oe or better or $11x + 25x = 180$ oe or better or M1 for $P = 11x$ or reflex $O = 360 - 22x$ or reflex $O = 50x$ allow on diagram

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	(c) 6.32 to 6.34 www	5	B1 for OLM 90° (seen or implied) allow on diagram and M1 for $LM = 8 \tan 44$ [7.7255...] or $OM = 8 \div \cos 44$ [11.1213...] and M1dep on previous M for $0.5 \times 8 \times \text{their } LM$ or $0.5 \times 8 \times (\text{their } OM) \sin 44$ and M1 for $\frac{44}{360} \times \pi \times 8^2$ oe [24.5 to 24.6]
9	(a) (i) 72 (ii) 68 (iii) 8 (iv) 164 (b) (i) 11 (ii) 35, 45, 55, 65, 75, 85 $(9 \times 35 + \text{their } 11 \times 45 + 16 \times 55 + 28 \times 65 + 108 \times 75 + 28 \times 85)$ [13990] $\div 200$ or <i>their</i> $\sum f$ 69.95 or 69.9 or 70[.0] cao	1 1 1 2 1 M1 M1 M1dep A1	M1 for 36 seen may be on the graph At least 5 correct mid - values soi $\sum fx$ where x is in the correct interval allow one further slip Depend on second method isw conversion to mins/secs & reference to classes SC2 for correct answer without working
10	(a) A 1, $13 - 2n$ oe B 36, n^2 oe C 42, $n(n + 1)$ oe D 729, 3^n oe E 687, $3^n - n(n + 1)$ oe	3 2 3 2 2ft	B1, B2 (M1 for $k - 2n$) oe B1, B1 B1, B2 (B1 for a quadratic in n) B1, B1 B1ft <i>their D – their C</i>, B1ft <i>their D – their C</i> only if both in terms of n

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	(b) (i) -187	1ft	ft if A is linear
	(ii) $10\ 100$	1ft	ft if C is quadratic
	(c) 8	1	
	(d) $58\ 939$	1	