## MARK SCHEME for the October/November 2011 question paper

## for the guidance of teachers

## 0580 MATHEMATICS

0580/31

Paper 3 (Core), maximum raw mark 104

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.

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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
	<b>.</b>

WWW	without wrong working
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Qu.		Answers	Mark	Part Marks
1	(a)	25 000 000 cao	1	
	(b)	$0.6 < 65\% < \frac{2}{3}$	1	
	(c)	20%	3	<b>B1</b> for 50 seen <b>M1</b> for $\frac{\text{their 50}}{250} \times 100$
				or <b>B1</b> for 0.8 or 80 seen
				<b>M1</b> for 1 – their 0.8 or 100 – their 80
	(d)		1	
		(ii) 40	2	<b>M1</b> for 360 – (90 + 150) implied by 120 seen
2	(a)	$1.5(0) \times 10^2$ cao	1	
	(b)	100 cao	1	
	(c)	2 hours 15 minutes cao	1	
	(d)	16(:) 25 (pm) or (0)425 <b>pm</b>	2	<b>M1</b> for 2.5 (oe), 2hrs 30 min
	(e)	$145 \le d < 155$	2	B1 for each value in correct place
3	(a)	(i) 36, 10	1	
		(ii) 29, 41, 13 any two	2	B1 for each
		(iii) 36	1	
		(iv) 45, 15, 10 any two	2	<b>B1</b> for each
	(b)	(i) 27	2	<b>B1</b> for 36 + 29 + + 13 seen implied by 189
		<b>(ii)</b> 29	2	M1 for attempting to order the numbers
		(iii) 35 cao	1	
	(c)	(i) $\frac{2}{7}$ oe	1	
		(ii) $\frac{3}{7}$ oe	1ft	Their denominator from (c)(i)

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<ul> <li>(vi) Correct region shaded</li> <li>(vi) Correct region shaded</li> <li>(vi) Correct region shaded</li> <li>(b) (i) Correct scale drawing of PQ</li> <li>(ii) Correct scale drawing of their QR</li> <li>(iii) Correct scale drawing of their QR</li> <li>(iii) 35 to 37</li> <li>(b) (ii) Correct scale drawing of their QR</li> <li>(ciii) 35 to 37</li> <li>(ciii) Correct scale drawing of their QR</li> <li>(ciii) 35 to 37</li> <li>(ciii) Correct scale drawing of their QR</li> <li>(ciii) 35 to 37</li> <li>(ciii) Correct scale drawing of their QR</li> <li>(ciii) Correct scale drawing of their QR</li> <li>(ciii) 35 to 37</li> <li>(ciii) Correct scale drawing of their QR</li> <li>(ciii) Correct scale drawing draw</li></ul>		1				[]
(b) (i) 15 cao1(ii) (1500 - 15) × 1.042(c) 561.923(d) (i) 3, 2, 63(e) 501.923(f) (ii) 3, 2, 63(iii) Correct continuous line2ft(iii) Correct continuous line2ft(iii) Correct continuous line2ft(iii) Correct construction2(iii) Correct construction2(iii) Correct construction2(iii) Correct construction2(iii) Correct construction2(iii) 47° (45 - 49)(iii) Correct construction2ft(iii) Correct construction2ft(iii) Correct construction2ft(iii) 47° (45 - 49)(iii) Correct construction2ft(iii) Correct scale drawing of PQ(ii) Correct scale drawing of PQ(ii) Correct scale drawing of PQ(ii) Correct scale drawing of their QR(ii) Correct scale drawing of their QR(iii) Correct scale drawing of the	4	(a)	(i)	70 cao	1	
Image: ConstructionImage: ConstructionImage: ConstructionImage: ConstructionImage: Construction6(a) $(-1, 2, v) = 4$ (b)(c) $(-1, 2, v) = 4$ (c)(c) $(-1, 2, v) = 4$ 6(a)(a)(a) $(-1, 2, v) = 4$ (c)(c)(c)(c) $(-1, 2, v) = 4$ 6(a)(a)(a)(c)Correct construction(c)(c)(c)(c)(c)7(a)(a)(c)Correct construction(c)(c)(c)(c)(c)6(a)(a)(b)(c)Correct construction(c)(c)(c)(c)7(c)(c)(c)(c)(c)(c)(c)(c)6(a)(a)(a)(a)(c)(c)(c)(c)(c)7(a)(a)(a)(a)(c)(c)(c)(c)(c)8(c)(c)(c)(c)(c)(c)(c)(c)7(c)(c)(c)(c)(c)(c)(c)8(c)(c)(c)(c)(c)(c)(c)9(c)(c)(c)(c)(c)(c)(c)9(c)(c)(c)(c)(c)(c)(c)9(c)(c)(c)(c)(c)(c)(c)9(c)(c)(c)(c)(c)(c)(c)9(c)(c) </th <th></th> <th></th> <th>(ii)</th> <th>1.11(11)</th> <th>2</th> <th><b>B1</b> for 100 <math>\div</math> 90, 10 <math>\div</math> 9, 1<math>\frac{1}{9}</math></th>			(ii)	1.11(11)	2	<b>B1</b> for 100 $\div$ 90, 10 $\div$ 9, 1 $\frac{1}{9}$
(c) $561.92$ 3MI for $1544.40 - 950 - 10 (584.40)$ oe MI indep for $\pm 1.04$ 5(a) $\frac{-4}{3}$ oe, $-1.2$ to $-1.4$ 2B1 for attempt at $\frac{rise}{run}$ (b)(i) $3, 2, 6$ 3B1 for each value(ii)Correct continuous line2ftMinimum length $(0,3)$ to $(6,0)$ B1 for plotting their 3 points(c) $x = -2, y = 4$ 2ftB1 for their $x, B1$ for their $y$ from their intersections6(a)(i)Correct construction2B1 for two lines or B1 for accurate arcs seen or B1 for one correct line with two arcs SC1 for $AC = 6$ and $BC = 7$ with arcs6(a)(i)Correct construction2ftTheir (a)(i) B1 for accurate arcs no line or B1 for accurate line with arcs bisecting another angle(iv)4 $(3.8 - 4.2)$ 1ftStrict ft their (iii) with intersection on opposite side of triangle(v)Correct construction2ftB1 for accurate line drawn no arcs or B1		<b>(b)</b>	(i)	15 cao	1	
M1 indep for $\div 1.04$ 5(a) $\frac{-4}{3}$ oc, $-1.2$ to $-1.4$ 2B1 for attempt at $\frac{\text{rise}}{\text{run}}$ (b) (i) 3, 2, 63B1 for each value(ii) Correct continuous line2ftMinimum length (0,3) to (6,0)(c) $x = -2, y = 4$ 2ftB1 for their x, B1 for their y from their intersections6(a) (i) Correct construction2B1 for two lines or B1 for accurate arcs seen or B1 for accurate arcs no line or B1 for accurate line with arcs bisecting another angle(iv) 4 (3.8 - 4.2)1ftStrict ft their (ii) with intersection on opposite side of triangle(v) Correct construction2ftB1 for accurate line with arcs bisecting another angle(vi) Correct region shaded1ftft is for boundaries of correct perpendicular bisector of their <i>BC</i> and correct angle bisector of their <i>ABC</i> , with or without arcs(b) (i) Correct scale drawing of <i>PQ</i> 2B1 for accurate angle 160°, B1 for <i>PQ</i> 8cm(iii) 35 to 371ftMeasure $\times 5 \pm 1$ km			(ii)	$(1500 - 15) \times 1.04$	2	<b>B1</b> for × 1.04, 1560, 15.60
(b) (i) 3, 2, 63BI for each value(ii) Correct continuous line2ftMinimum length $(0,3)$ to $(6,0)$ (c) $x = -2, y = 4$ 2ftBI for their x, BI for their y from their intersections6(a) (i) Correct construction2BI for two lines or BI for accurate arcs seen or BI for one correct line with two arcs SC1 for $AC = 6$ and $BC = 7$ with arcs(ii) $47^{\circ} (45 - 49)$ 1ftStrict ft their (a)(i)(iii) Correct construction2ftBI for accurate arcs no line or BI for accurate arcs no line or BI for accurate line drawn no arcs or BI for accurate line with arcs bisecting another angle(iv) 4 (3.8 - 4.2)1ftStrict ft their (ii) with intersection on opposite side of triangle(v) Correct construction2ftBI for accurate arcs no line or BI for accurate line with arcs, bisecting AB or A(vi) Correct region shaded1ftft is for boundaries of correct perpendicular bisector of their BC and correct angle bisector of their BC with or without arcs(b) (i) Correct scale drawing of PQ2BI for accurate angle 40°, BI for QR 6cm(ii) 35 to 371ftMeasure × 5 ± 1km		(c)	561.	92	3	
(ii)Correct continuous line2ftMinimum length $(0,3)$ to $(6,0)$ B1 for plotting their 3 points(c) $x = -2, y = 4$ 2ftB1 for their $x$ , B1 for their $y$ from their intersections6(a)(i)Correct construction2B1 for two lines or B1 for accurate arcs seen or B1 for one correct line with two arcs SC1 for $AC = 6$ and $BC = 7$ with arcs(ii) $47^{\circ}(45 - 49)$ 1ftStrict ft their (a)(i)(iii)Correct construction2ftTheir (a)(i) B1 for accurate arcs no line or B1 for accurate line with arcs bisecting another angle(iv)4 $(3.8 - 4.2)$ 1ftStrict ft their (iii) with intersection on opposite side of triangle(v)Correct construction2ftB1 for accurate arcs no line or B1 for accurate line with arcs, bisecting $AB$ or $A$ t is for boundaries of correct perpendicular bisector of their $BC$ and correct angle bisector of their $ABC$ , with or without arcs(b)(i)Correct scale drawing of $PQ$ (ii)2B1 for accurate angle $40^{\circ}$ , B1 for $QR$ 6cm (iii) 35 to 37	5	(a)	$\frac{-4}{3}$	oe, -1.2 to -1.4	2	<b>B1</b> for attempt at $\frac{\text{rise}}{\text{run}}$
B1 for plotting their 3 points(c) $x = -2, y = 4$ 2ftB1 for their x, B1 for their y from their intersections6(a) (i) Correct construction2B1 for two lines or B1 for accurate arcs seen or B1 for one correct line with two arcs SC1 for $AC = 6$ and $BC = 7$ with arcs6(ii) $47^{\circ} (45 - 49)$ 1ftStrict ft their (a)(i)(iii) Correct construction2ftTheir (a)(i) B1 for accurate arcs no line or B1 for accurate line drawn no arcs or B1 for accurate line with arcs bisecting another angle(iv) 4 (3.8 - 4.2)1ftStrict ft their (ii) with intersection on opposite side of triangle(v) Correct construction2ftB1 for accurate arcs no line or B1 for accurate line drawn no arcs or B1 for accurate angle bisector of their ABC, with or without arcs(b) (i) Correct scale drawing of PQ (ii) Correct scale drawing of their QR (iii) 35 to 37B1 for accurate angle 160°, B1 for QR 6cm		<b>(b)</b>	(i)	3, 2, 6	3	B1 for each value
6(a) (i) Correct construction2B1 for two lines or B1 for accurate arcs seen or B1 for one correct line with two arcs SC1 for $AC = 6$ and $BC = 7$ with arcs(ii) $47^{\circ} (45 - 49)$ 1ftStrict ft their (a)(i)(iii) Correct construction2ftTheir (a)(i) B1 for accurate arcs no line or B1 for accurate line drawn no arcs or B1 for accurate line with arcs bisecting another angle(iv) 4 ( $3.8 - 4.2$ )1ftStrict ft their (iii) with intersection on opposite side of triangle(v) Correct construction2ftB1 for accurate arcs no line or B1 for accurate line with arcs bisecting another angle(v) Correct construction2ftB1 for accurate arcs no line or B1 for accurate arcs no line or B1 for accurate line with arcs, bisecting AB or A B1 for accurate line with arcs, bisecting AB or A(vi) Correct region shaded1ftft is for boundaries of correct perpendicular bisector of their ABC, with or without arcs(b) (i) Correct scale drawing of PQ (ii) Correct scale drawing of their QR (iii) $35$ to $37$ 2B1 for accurate angle $160^{\circ}$ , B1 for QR 6cm			(ii)	Correct continuous line	2ft	
B1 for one correct line with two arcs SC1 for $AC = 6$ and $BC = 7$ with arcs(ii) $47^{\circ}(45 - 49)$ 1ft(iii) Correct construction2ft(iii) Correct construction2ftTheir (a)(i) B1 for accurate arcs no line or B1 for accurate line drawn no arcs or B1 for accurate line with arcs bisecting another angle(iv) 4 ( $3.8 - 4.2$ )1ftStrict ft their (iii) with intersection on opposite side of triangle(v) Correct construction2ftB1 for accurate arcs no line or B1 for accurate line drawn no arcs or B1 for accurate line with arcs, bisecting AB or A B1 for accurate line with arcs, bisecting AB or A(vi) Correct region shaded1ft(ii) Correct scale drawing of PQ (ii) Correct scale drawing of their QR (iii) 35 to 372B1 for accurate angle 160°, B1 for QR 6cm (iii) 35 to 371ft		(c)	x = 1	-2, y = 4	2ft	
(iii) Correct construction2ftTheir (a)(i) B1 for accurate arcs no line or B1 for accurate line drawn no arcs or B1 for accurate line with arcs bisecting another angle(iv) 4 $(3.8 - 4.2)$ 1ftStrict ft their (iii) with intersection on opposite side of triangle(v) Correct construction2ftB1 for accurate arcs no line or B1 for accurate arcs no line or B1 for accurate line with arcs, bisecting AB or A (vi) Correct region shaded1ft(vi) Correct scale drawing of PQ (ii) Correct scale drawing of their QR (iii) 35 to 372B1 for accurate angle 160°, B1 for QR 6cm B1 for accurate angle 160°, B1 for QR 6cm	6	(a)	(i)	Correct construction	2	<b>B1</b> for one correct line with two arcs
or B1 for accurate line drawn no arcs or B1 for accurate line with arcs bisecting another angle(iv) 4 $(3.8 - 4.2)$ 1ftStrict ft their (iii) with intersection on opposite side of triangle(v) Correct construction2ftB1 for accurate arcs no line or B1 for accurate line drawn no arcs or B1 for accurate line with arcs, bisecting AB or A B1 for accurate line with arcs, bisecting AB or A B1 for accurate line with arcs, bisecting AB or A ft is for boundaries of correct perpendicular bisector of their BC and correct angle bisector of their ABC, with or without arcs(b) (i) Correct scale drawing of PQ (ii) Correct scale drawing of their QR (iii) 35 to 372B1 for accurate angle 40°, B1 for QR 6cm(iii) 35 to 371ftMeasure $\times 5 \pm 1$ km			(ii)	47° (45 – 49)	1ft	Strict ft their (a)(i)
(v) Correct constructionSide of triangle(v) Correct construction2ftB1 for accurate arcs no line or B1 for accurate line drawn no arcs or B1 for accurate line with arcs, bisecting AB or A ft is for boundaries of correct perpendicular bisector of their BC and correct angle bisector of their ABC, with or without arcs(b) (i) Correct scale drawing of PQ (ii) Correct scale drawing of their QR (iii) 35 to 372B1 for accurate angle 40°, B1 for PQ 8cm B1 for accurate angle 160°, B1 for QR 6cm			(iii)	Correct construction	2ft	or <b>B1</b> for accurate line drawn no arcs or <b>B1</b> for accurate line with arcs bisecting
<ul> <li>(vi) Correct region shaded</li> <li>(vi) Correct region shaded</li> <li>(vi) Correct scale drawing of PQ</li> <li>(ii) Correct scale drawing of their QR</li> <li>(iii) 35 to 37</li> <li>(b) (i) Correct scale drawing of their QR</li> <li>(iii) 35 to 37</li> <li>(b) (i) Correct scale drawing of PQ</li> <li>(ci) Correct scale drawing of their QR</li> <li>(ci) Correct scale drawing drawing</li></ul>			(iv)	4 (3.8-4.2)	1ft	
<ul> <li>(b) (i) Correct scale drawing of PQ</li> <li>(ii) Correct scale drawing of their QR</li> <li>(iii) 35 to 37</li> <li>(b) (i) Correct scale drawing of their QR</li> <li>(iii) 35 to 37</li> <li>(iii) Correct scale drawing of their QR</li> <li>(iii) 35 to 37</li> </ul>			(v)	Correct construction	2ft	
(ii) Correct scale drawing of their $QR$ 2B1 for accurate angle 160°, B1 for $QR$ 6cm(iii) 35 to 371ftMeasure $\times$ 5 $\pm$ 1km			(vi)	Correct region shaded	1ft	bisector of their BC and correct angle bisector
(iii) 35 to 37 1ft Measure $\times$ 5 $\pm$ 1km		(b)	(i)	Correct scale drawing of PQ	2	<b>B1</b> for accurate angle $40^\circ$ , <b>B1</b> for <i>PQ</i> 8cm
			(ii)	Correct scale drawing of their QR	2	<b>B1</b> for accurate angle $160^\circ$ , <b>B1</b> for <i>QR</i> 6cm
			(iii)	35 to 37	1ft	Measure $\times$ 5 ± 1km
(iv) 264 to 268 1ft			(iv)	264 to 268	1ft	

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		1	1
7	(a) -6 www	3	M2 for $8 = x + 6 + 8$ or better or $-x + 8 = 6 + 8$ or better M1 for $2x + 8$ or $3x + 6$ or $3x + 14$
	<b>(b)</b> $\frac{3-b}{a}$ or $\frac{3}{a} - \frac{b}{a}$	2	<b>B1</b> for 3 – b seen or $z + \frac{b}{a} = \frac{3}{a}$
	(c) 3	2	<b>B1</b> for $\frac{54}{2}$ or better
			SC1 for embedded answer ie $2 \times 3^3 = 54$ or $2 \times 3 \times 3 \times 3 = 54$
	(d) (i) $x + x + 2x - 5 + 2x - 5 = 6x - 5x - 5 = 6x - 5x -$	10 2	M1 accept $2x + 2(2x - 5)$ or $2(x + 2x - 5)$ E1 dep
	<b>(ii)</b> 10	2	<b>M1</b> for $6x - 10 = 50$
8	(a) Translation $\begin{pmatrix} 0 \\ -6 \end{pmatrix}$	2	B1 for translation B1 for column vector
	(b) Correct line drawn	1	Continuous full line. Accept freehand.
	(c) (i) Correct reflection	1ft	Their (b)
	(ii) Correct enlargement	2	<b>B1</b> for any other enlargement scale factor 2
9	(a) $3x(x+4)$	2	<b>B1</b> for $3(x^2 + 4x)$ or <b>B1</b> for $x(3x + 12)$ or <b>B1</b> for $3x(x + 4)$ seen (if not final answer)
	<b>(b)</b> 20	2	<b>B1</b> for 8 or 12 seen
	(c) $6x^7$	2	<b>B1</b> for $kx^7$ or for $6x^k$ , $k \neq 0$
10	(a) 5.4 cao	3	M1 for $2^2 + 5^2 (= x^2)$ implied by 29 A1 5.38(51) or $\sqrt{29}$ or 5.39 B1 indep for rounding their answer to 1 decimal place
	(b) 5	2	M1 for $0.5 \times 5 \times 2$ oe
	(c) 50	1ft	$10 \times \text{their} (\mathbf{b})$
	( <b>d</b> ) 134	3ft	M2 for $2 \times$ their (b) + $10 \times$ their (a) + $2 \times 10$ + $5 \times 10$ or better M1 for any 3 faces correct
	<b>(e)</b> 301.5(0)	1ft	Their (d) $\times$ 2.25
11	(a) Correct shape drawn	1	
	<b>(b)</b> 16, 21, 26	3	<b>B1</b> for each SC1 "their 16" + 5 SC1 "their 21" + 5
	(c) 41	1	
	(d) $5n+1$	2	<b>B1</b> for 5 <i>n</i> , <b>B1</b> for +1
	(e) 501	1ft	Their (d) if linear
	(f) 13	2ft	Their (d) if linear B1 for their (d) = 66