

**MARK SCHEME for the October/November 2007 question paper**

**0580 and 0581 MATHEMATICS**

**0580/04 and 0581/04** 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.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

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### **Abbreviations**

In addition to those already seen the following may crop up.

cao – correct answer only

ww – without working

www – without wrong working

oe – or equivalent

soi – seen or implied

bod – benefit of doubt

art – anything rounding to

isw – ignore subsequent working

ft – follow through

oor – out of range

isr – ignore subsequent rounding

rot – rounded or truncated

mog – marks on graph

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1	(a) (i)	$385 \times 0.9$ oe (\$) <b>346.5(0)</b> cao	M1 A1	Implied by ans 346 or 347 www2
	(ii)	$385 \div 1.1(0)$ oe (\$) <b>350</b> cao	M1 A1	www2
	(b) (i)	$\frac{23}{23+19} \times 210$ oe <b>115</b> cao	M1 A1	www2
	(ii)	their (i) $\times 2.50 + (210 - \text{their (i)}) \times 1.50$ (\$) <b>430</b> cao	M1 A1	(287.5 + 142.5) www2
	(iii)	$\{\text{their (ii)} - 410\} / 410 (\times 100)$ oe <b>4.88</b>	M1 A1	Dep on (ii) being greater than 410 www2 (4.878 ...) After M0, SC1 for 104.9 or better or 4.9 ww
	(c)	$2.6(210 - x)$ or $1.4(210 - x)$ seen $2.6(210 - x) + 1.4x = 480$ $546 - 480 = 2.6x - 1.4x$ <b>or</b> $2.6x - 1.4x = 480 - 294$ <b>55</b> cao	M1 M1 M1 A1	Allow $2.6x + 1.4(210 - x) = 480$  Dep on M2 if trial and error, B4 or B0 if using simultaneous equations $x + y = 210$ M1 $1.4x + 2.6y = 480$ M1 variable eliminated by correct method M1d After 0 scored, SC2 for ans 155
	<b>[14]</b>			

2	(a) (i)	<b>6</b>	B1	Allow 1 slip  dep on 1 <sup>st</sup> M1 www 3 4.53571... <i>Accept all <b>probabilities</b> as fract/dec/% -1 once for words or 2 sf, do not accept ratios i.s. cancelling after correct answer.</i> www2 e.g. ( $\frac{12}{756}$ , 0.0159 etc)  www2 e.g. ( $\frac{12}{420}$ , 0.0286 etc)  www2 e.g. ( $\frac{2208}{19656}$ , 0.112)
	(ii)	<b>4.5</b>	B1	
	(iii)	$(1 \times 1 + 2 \times 2 + 4 \times 3 + 7 \times 4 + 4 \times 5 + 8 \times 6 + 2 \times 7)$ (127) $\div 28$ <b>4.54</b>	M1 A1	
	(iv)	$\frac{4}{28} \times \frac{3}{27}$ $\frac{1}{63}$ o.e.	M1 A1	
	(v)	$\frac{4}{21} \times \frac{3}{20}$ $\frac{1}{35}$ o.e.	M1 A1	
	(vi)	$\frac{24}{28} \times \frac{23}{27} \times \frac{4}{26}$ $\frac{92}{819}$ o.e.	M1 A1	
	(b) (i)	<b>0.08</b> o.e.	B1	
	(ii)	$0.9 \times 0.05$ their (b)(i) $+ 0.9 \times 0.05$ <b>0.125</b> o.e.	M1 M1dep A1	
	(iii)	<b>7</b>	B1 ft	
	<b>[16]</b>			

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3	(a) (i)	(0, 1)	B1	Accept w/out brackets/ commas, condone vectors, or states $x = , y =$	
	(ii)	(4, 0) and (0, 4)	B1B1		
	(b)	-1 cao	B1		
	(c)	$(x) < 0$ (allow $\leq$ )	B1		Any other variable $< 0$ B0
	(d)	$x^2 + 1 = 4 - x$ o.e.	B1		must be these 4 terms
	(e)	$\frac{p+(-)\sqrt{q}}{r}$ where $p = -1$ and $r = 2 \times 1$ and $q = 1^2 - 4(1)(-3)$ o.e.	M1 M1		Allow second mark if in form $p \pm \frac{\sqrt{q}}{r}$
		-2.30, 1.30 cao www4	A1A1	If ww ans.correct but wrong acc - SC3 After A0, A0, SC1 for -2.3027756 and 1.3027756 rounded or truncated	
	(f)	(-0.5, 4.5 or 4.49)	B1ft B1 ft	f.t (their -2.30 + their 1.30) $\div 2$ ft (4 - their $x$ co-ord dep on attempt at mid value of $x$ from values in e) [12]	

4	(a) (i)	$4\pi 3.5^2 = 153.86$ to 153.96 or 154	M1A1	www2
	(ii)	$\frac{4}{3}\pi 3.5^3 = 179.5$ to 179.62 or 180	M1A1	www2
	(iii)	their (ii) $\times 5.6$ 1005 to 1006 or 1008 or 1010 (g)	M1 A1ft	their (ii) $\times 5.6$ correct to 3sf or better (allow in kg)
	(b)	$\pi 8^2 \times 8$ (1608-1609) $\pi 8^2 h = 2 \times$ their (ii) + $\pi 8^2 \times 8$ $(2 \times$ their (ii) + $\pi 8^2 \times 8) \div (\pi 8^2)$ 9.78 to 9.79 (cm)	M1 M1dep M1dep A1	<u>Alt</u> $\pi 8^2 d = 2 \times$ their (ii) M1 $(2 \times$ their (a)(ii)) $\div (\pi 8^2)$ M1dep add 8 M1dep www4
	(c)	1000 (or 1) $\div 4.8 \div \frac{4}{3}\pi$ $\sqrt[3]{ans}$ (or $10 \times \sqrt[3]{ans}$ ) 3.67 to 3.68 (cm)	M1 M1dep A1	49.7..... (or 0.0497) Dep on previous M1 www3 figs 368 or ans 3.7 gets M2 [13]

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5	(a) (i)	$\sqrt{7^2 - 4^2} = 5.74$ (cm)	M1A1	www2 5.74456...	
	(ii)	6.32 (cm)	B1	6.32455.....	
	(b)	$2 \times \frac{1}{2} \times 8 \times '5.74' + 2 \times \frac{1}{2} \times 6 \times '6.32' + 8 \times 6$ 131.8 to 132 (cm <sup>2</sup> )	M1 A1ft	www2 ft 48 + 8 × their (a)(i) + 6 × their (a)(ii)	
	(c) (i)	$((PX)^2) = (\text{their (a)(i)})^2 - 3^2$ $\sqrt{24}$ soi or 4.898..... seen	M1 E1	or their a(ii) <sup>2</sup> - 4 <sup>2</sup> or 7 <sup>2</sup> - (3 <sup>2</sup> + 4 <sup>2</sup> )	
	(ii)	$\text{Tan(PNX)} = \frac{\text{their(c)(i)}}{4}$ o.e. 50.7 to 50.84 oe	M1	Alt correct trig methods involving their (a)(ii) M1 for correct explicit statement	
	(iii)	(HPN) 180 - 2 × their (ii) 78.3 to 79	A1 M1 A1	www2 for a trig ratio www2 Alt - cos rule method - M1 at explicit stage	
	(iv)	$\tan = \frac{\text{their(c)(i)}}{5}$ o.e. 44.4 to 44.43°	M2 A1	M1 for recognition of angle PAX or PAC oe Alt trig methods with PA = 7 used	
	(v)	PHN or PGM o.e. (letters)	B1	www3 44.4153086 B0 if extras	
					[15]

6	(a) (i)	AB=13 cm and BD=15 cm (± 2 mm) Angle A = 80° (± 2°) A,B,C,D correct within 4 mm	B1 B1 B1	Dep. on B2	
	(ii)	Angle ADB correct (57-61°) (± 2°) Angle DCB correct (101-105°) (± 2°)	B1ft B1ft	Either in working or written on diagram	
	(iii)	Acc. bisector of angle A with arcs (at least 5 cm long) (± 2°)(± 2 mm)	B2ft	B1 for accurate without/wrong arcs	
	(iv)	Acc. perp. bisector of AD with at least 1 pair of arcs (± 2°)(± 2 mm) (at least 5 cm long)	B2ft	B1 for accurate without/wrong arcs B1 for each if accurate with arcs but short	
	(v)	'Correct' area shaded below their perp. bisector and below their angle bisector	B1	Dep. on at least B1 in (iii) and B1 in (iv)	
	(b) (i)	$\frac{\sin D}{26} = \frac{\sin 80}{30}$ $(\sin D) = \frac{26 \sin 80}{30}$ 58.57 to 58.6°	M1 M1dep	No M marks in (b) for <u>measuring + using</u> lengths from diagram e.g. AD = 20 m but allow 13, 15, 9 used for 26, 30, 18 in b dep on 1 <sup>st</sup> M	
	(ii)	Angle BDC = 41.4 $(BC^2) = 18^2 + 30^2 - 2 \times 18 \times 30 \cos '41.4'$ square root of correct collection 20.3 to 20.35 (m) cao	A1 B1 ft M1 M1dep	www3 Ft 100 - their 58.6 Allow 41 or 42 for angle BDC Dep on 1 <sup>st</sup> M (413.88... )	
	(iii)	$0.5 \times 26 \times 30 \sin '41.4' +$ $0.5 \times 18 \times 30 \sin '41.4'$ oe 436 to 437 (m <sup>2</sup> ) cao	A1 M2 A1	www4 M1 for correct area of one triangle (257.9 or 178.6). Must see calc for trapezium height if used (30 sin '41.4') Allow 41 or 42 for angle BDC www3	
					[20]

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7 (a)	Correct axes	<b>S1</b>	must fit on paper 2mm acc throughout Ignore labels on triangles throughout
(b)	Correct triangle drawn (T)	<b>T1</b>	vertices at (8, 6), (6, 10) and (10, 12)
(c) (i)	Correct reflection in $y = x$ drawn (P)	<b>P2ft</b>	ft their T, P1 for two correct vertices drawn (6, 8), (10, 6), (12, 10) <b>or</b> line $y = x$ correctly drawn (within 2mm of (12,12) if extended)
(ii)	$\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$	<b>B2</b>	B1 for a correct column
(d) (i)	Correct enlargement, scale factor 0.5, centre (0,0) drawn (Q)	<b>Q2ft</b>	(4, 3), (3, 5), (5, 6) Q1 for any enlargement s.f. $\frac{1}{2}$ or 2 correct vertices drawn SC1 for 3 points within 5 mm if rays method used <b>or</b> for correct enlargement but of P
(ii)	Enlargement only (scale factor) 0.5 (centre) (0, 0) o.e.	<b>B1</b> <b>B1</b> <b>B1</b>	indep indep indep
(e)	Correct stretch drawn (R)	<b>R2ft</b>	R1 for two correct vertices ft (4, 6), (3, 10), (5, 12)
			<b>[13]</b>

8 (a)	<b>2</b>	<b>B1</b>	
(b)	$\frac{3}{2x-1} + 1$ $\frac{3+2x-1}{2x-1}$ $\frac{2+2x}{2x-1}$ o.e. final ans	<b>M1</b> <b>M1</b> <b>A1</b>	Dep on 1 <sup>st</sup> M1  www3
(c)	$y = \frac{3}{x} + 1$ $y-1 = \frac{3}{x} \text{ or } xy = 3 + x$  $x(y-1) = 3$ $\frac{3}{x-1}$ o.e. final answer	<b>M1</b>  <b>M1dep</b> <b>A1</b>	$x = \frac{3}{y} + 1$  Alt $x-1 = \frac{3}{y}$  Dep on 1 <sup>st</sup> M1 $y(x-1) = 3$ www3 $\frac{3}{x-1}$ o.e. If answer is $x = \frac{3}{x-1}$ allow M2
(d)	<b>256</b>	<b>B2</b>	B1 for $2^3 = 8$ or $2^8$ seen
(e)	$2^x = \frac{3}{-24/7} + 1$ <b>-3</b>	<b>M1</b>  <b>A1</b>	M for r.h.s. followed by attempt at recognising $2^x = \dots\dots\dots$  After M0, SC1 for $1/8$ o.e seen www2
			<b>[11]</b>

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9 (a)	$-7, 512, \frac{8}{9}, 81, 2187, -2106$	<b>B6</b>	B1 each. Allow in any order ignore letters
(b) (i)	(P) $9 - 2n$	<b>B1</b>	Accept correct expressions in any form e.g. $7 - 2(n - 1)$ If 'n =' withhold the first mark earned
(ii)	(Q) $n^3$	<b>B1</b>	
(iii)	(R) $\frac{n}{n+1}$	<b>B1</b>	
(iv)	(S) $(n+1)^2$	<b>B1</b>	
(v)	(T) $3^{n-1}$	<b>B1</b>	
(vi)	(U) $(n+1)^2 - 3^{n-1}$	<b>B1ft</b>	
(c)	their(b)(i) = - 777 393 cao	<b>M1</b> <b>A1</b>	www2
(d)	12	<b>B2</b>	SC1 for 11 or $n - 1 = 11$ or $3^{12}, 3^{11}$ seen [16]