

# Straight Line Past Papers Unit 1 Outcome 1

## Multiple Choice Questions

Each correct answer in this section is worth two marks.

1. The line with equation  $y = ax + 4$  is perpendicular to the line with equation  $3x + y + 1 = 0$ .

What is the value of  $a$ ?

- A.  $-3$
- B.  $-\frac{1}{3}$
- C.  $\frac{1}{3}$
- D.  $3$

Key	Outcome	Grade	Facility	Disc.	Calculator	Content	Source
C	1.1	C	0.7	0.62	NC	G2, G5	HSN 089

$3x + y + 1 = 0$   
 $y = -3x - 1$ . So  $m_1 = -3$ . Compare to  
 $y = mx + c$

The line  $y = ax + 4$  has gradient  $m_2 = a$

Since the lines are perpendicular,  $m_1 \times m_2 = -1$ , ie

$-3a = -1$   
 $a = \frac{1}{3}$ .

Option C

[END OF MULTIPLE CHOICE QUESTIONS]

## Written Questions

- [SQA] 2. Find the equation of the perpendicular bisector of the line joining A(2, -1) and B(8, 3).

4

part marks	Unit	non-calc		calc		calc neut		Content Reference :		1.1
		C	A/B	C	A/B	C	A/B	Main	Additional	
4	1.1					4		1.1.1	1.1.9	Source 1996 P1 qu.1

- <sup>1</sup> midpoint = (5,1)
- <sup>2</sup>  $m_{AB} = \frac{2}{3}$
- <sup>3</sup>  $m_{\perp} = -\frac{3}{2}$
- <sup>4</sup>  $y - 1 = -\frac{3}{2}(x - 5)$

- [SQA] 3. Find the equation of the straight line which is parallel to the line with equation  $2x + 3y = 5$  and which passes through the point (2, -1).

3

Part	Marks	Level	Calc.	Content	Answer	U1 OC1
	3	C	CN	G3, G2	$2x + 3y = 1$	2001 P1 Q1

- <sup>1</sup> ss: express in standard form
- <sup>2</sup> ic: interpret gradient
- <sup>3</sup> ic: state equation of straight line
- <sup>1</sup>  $y = -\frac{2}{3}x + \frac{5}{3}$  stated or implied by •<sup>2</sup>
- <sup>2</sup>  $m_{\text{line}} = -\frac{2}{3}$  stated or implied by •<sup>3</sup>
- <sup>3</sup>  $y - (-1) = -\frac{2}{3}(x - 2)$

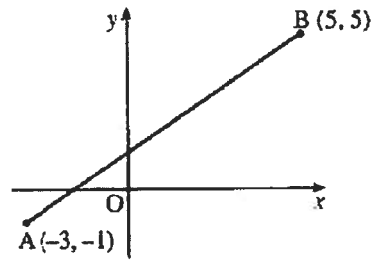
- [SQA] 4. Find the equation of the line through the point (3, -5) which is parallel to the line with equation  $3x + 2y - 5 = 0$ .

2

part marks	Unit	non-calc		calc		calc neut		Content Reference :		1.1
		C	A/B	C	A/B	C	A/B	Main	Additional	
2	1.1					2		1.1.7	1.1.8	Source 1991 P1 qu.1

- <sup>1</sup>  $m = -\frac{3}{2}$  stated or implied by •<sup>2</sup>
- <sup>2</sup>  $y - (-5) = -\frac{3}{2}(x - 3)$

- [SQA] 5. A and B are the points  $(-3, -1)$  and  $(5, 5)$ .  
 Find the equation of  
 (a) the line AB  
 (b) the perpendicular bisector of AB.



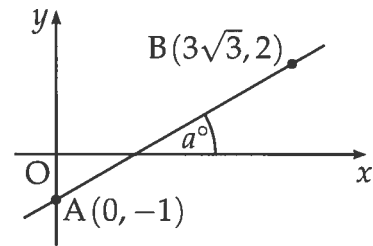
2  
3

part	marks	Unit	non-calc		calc		calc neut		Content Reference :		1.1
			C	A/B	C	A/B	C	A/B	Main	Additional	
(a)	2	1.1					2		1.1.7		Source
(b)	3	1.1					3		1.1.10		1999 P1 qu.2

<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>m_{AB} = \frac{3}{4}</math></li> <li>•<sup>2</sup> <math>y - 5 = \frac{3}{4}(x - 5)</math> or <math>y - (-1) = \frac{3}{4}(x - (-3))</math></li> </ul>	<ul style="list-style-type: none"> <li>•<sup>3</sup> <math>m_{\perp} = -\frac{4}{3}</math></li> <li>•<sup>4</sup> midpoint = <math>(1, 2)</math></li> <li>•<sup>5</sup> <math>y - 2 = -\frac{4}{3}(x - 1)</math></li> </ul>
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- [SQA] 6. Find the size of the angle  $a^\circ$  that the line joining the points  $A(0, -1)$  and  $B(3\sqrt{3}, 2)$  makes with the positive direction of the  $x$ -axis.



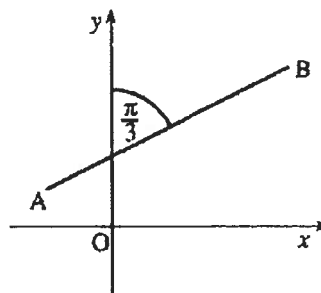
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Part	Marks	Level	Calc.	Content	Answer	U1 OC1
	3	C	NC	G2	30	2000 P1 Q3

<ul style="list-style-type: none"> <li>•<sup>1</sup> ss: know how to find gradient or equ.</li> <li>•<sup>2</sup> pd: process</li> <li>•<sup>3</sup> ic: interpret exact value</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>\frac{2 - (-1)}{3\sqrt{3} - 0}</math></li> <li>•<sup>2</sup> <math>\tan a = \text{gradient}</math> stated or implied by</li> <li>•<sup>3</sup> <math>a = 30</math></li> </ul>
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- [SQA] 7. The line AB makes an angle of  $\frac{\pi}{3}$  radians with the  $y$ -axis, as shown in the diagram. Find the exact value of the gradient of AB.



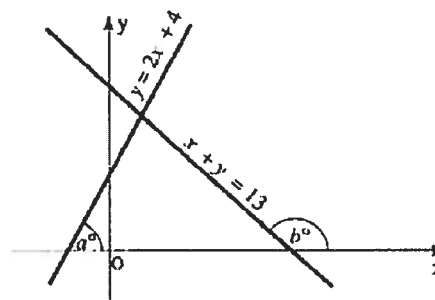
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part marks	Unit	non-calc		calc		calc neut		Content Reference :		1.1
		C	A/B	C	A/B	C	A/B	Main	Additional	
2	1.1						2	1.1.7		Source 1999 P1 qu.7

<ul style="list-style-type: none"> <li>•<sup>1</sup> "correct angle" = <math>\frac{\pi}{2} - \frac{\pi}{3}</math></li> <li>•<sup>2</sup> <math>\frac{1}{\sqrt{3}}</math></li> </ul>
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- [SQA] 8. The lines  $y = 2x + 4$  and  $x + y = 13$  make angles of  $a^\circ$  and  $b^\circ$  with the positive direction of the  $x$ -axis, as shown in the diagram.

- (a) Find the values of  $a$  and  $b$ .  
 (b) Hence find the acute angle between the two given lines.

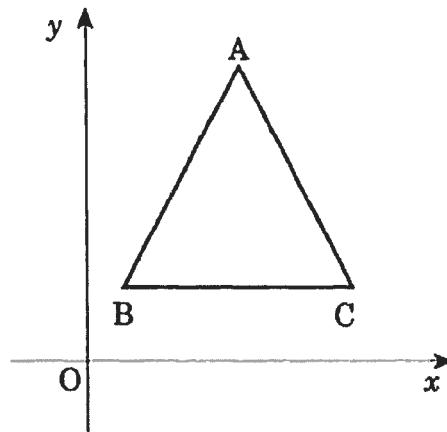


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1

part marks	Unit	non-calc		calc		calc neut		Content Reference :		1.1
		C	A/B	C	A/B	C	A/B	Main	Additional	
(a) 4	1.1			4				1.1.3		Source
(b) 1	0.1			1				0.1		1993 P1 qu.10

<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>\tan a^\circ = 2</math></li> <li>•<sup>2</sup> <math>a = 63.4^\circ</math></li> <li>•<sup>3</sup> <math>\tan(180 - b) = 1</math></li> <li>•<sup>4</sup> <math>b = 135</math></li> <li>•<sup>5</sup> <math>180 - a - (180 - b)</math> or equiv. to <math>b - a</math></li> </ul>
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- [SQA] 9. A triangle ABC has vertices A(4, 8), B(1, 2) and C(7, 2).



- (a) Show that the triangle is isosceles. (2)
- (b) (i) The altitudes AD and BE intersect at H, where D and E lie on BC and CA respectively. Find the coordinates of H. (7)
- (ii) Hence show that H lies one quarter of the way up DA. (1)

part	marks	Unit	non-calc		calc		calc neut		Content Reference :		1.1
			C	A/B	C	A/B	C	A/B	Main	Additional	
(a)	2	1.1					2		1.1.2		Source 1995 Paper 2 Qu.1
(b)	8	1.1					8		1.1.10, 0.1		

(a) •<sup>1</sup> Calculate the length of the sides

•<sup>2</sup>  $AB = AC = \sqrt{3^2 + 6^2}$

(b) •<sup>3</sup> knows to find equ. of an altitude

•<sup>4</sup>  $m_{AC} = -2$

•<sup>5</sup>  $m_{BE} = \frac{1}{2}$

•<sup>6</sup>  $y - 2 = \frac{1}{2}(x - 1)$

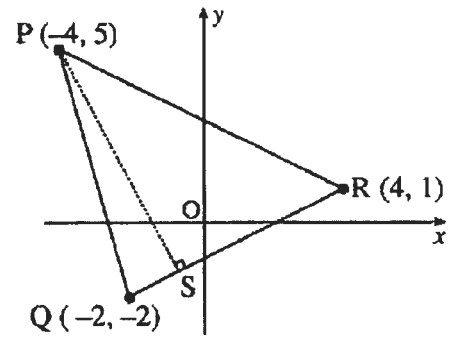
•<sup>7</sup>  $x = 4$  stated or implied

•<sup>8</sup> knows how to find intersection

•<sup>9</sup>  $H = \left(4, \frac{7}{2}\right)$

•<sup>10</sup>  $DA = 6$  and  $DH = 1\frac{1}{2}$

- [SQA] 10.  $P(-4, 5)$ ,  $Q(-2, -2)$  and  $R(4, 1)$  are the vertices of triangle PQR as shown in the diagram. Find the equation of PS, the altitude from P.



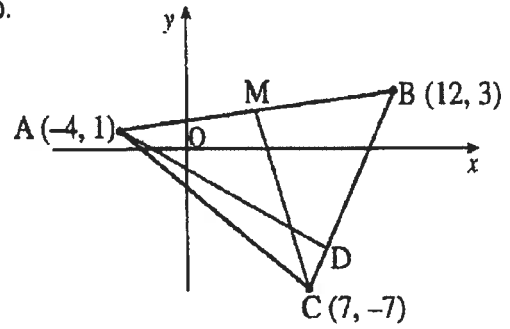
3

part	marks	Unit	non-calc		calc		calc neut		Content Reference :		1.1
			C	A/B	C	A/B	C	A/B	Main	Additional	
.	3	1.1					3		1.1.1	1.1.9, 1.1.7	Source 1997 P1 qu.1

- <sup>1</sup>  $m_{QR} = \frac{1}{2}$
- <sup>2</sup>  $m_{PN} = -2$
- <sup>3</sup>  $PN: y - 4 = -2(x + 3)$

[SQA] 11. A triangle ABC has vertices A (-4, 1), B (12, 3) and C (7, -7).

- (a) Find the equation of the median CM.
- (b) Find the equation of the altitude AD.
- (c) Find the coordinates of the point of intersection of CM and AD.



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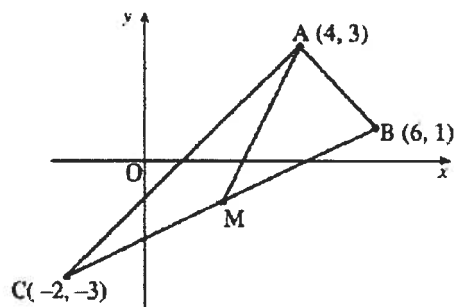
part	marks	Unit	non-calc		calc		calc neut		Content Reference :		1.1
			C	A/B	C	A/B	C	A/B	Main	Additional	
(a)	3	1.1					3		1.1.7		Source 1999 Paper 2 Qu. 1
(b)	3	1.1					3		1.1.7	1.1.9	
(c)	3	0.1					3		0.1		

(a) •<sup>1</sup> midpoint = (4, 2)  
 •<sup>2</sup>  $m_{MC} = -3$   
 •<sup>3</sup>  $y - 2 = -3(x - 4)$  or  $y - (-7) = -3(x - 7)$

(b) •<sup>4</sup>  $m_{BC} = 2$   
 •<sup>5</sup>  $m_{\perp} = -\frac{1}{2}$   
 •<sup>6</sup>  $y - 1 = -\frac{1}{2}(x - (-4))$

(c) •<sup>7</sup> e.g.  $3x + y = 14$  and  $x + 2y = -2$   
 •<sup>8</sup> attempt to eliminate a variable  
 •<sup>9</sup> (6, -4)

- [SQA] 12. A triangle ABC has vertices A(4, 3), B(6, 1) and C(-2, -3) as shown in the diagram. Find the equation of AM, the median from A.

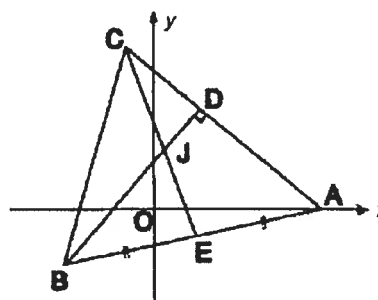


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part	marks	Unit	non-calc		calc		calc neut		Content Reference :		1.1
			C	A/B	C	A/B	C	A/B	Main	Additional	
.	3	1.1					3		1.1.6	1.1.7	Source 1998 P1 qu.1

- <sup>1</sup>  $M = (2, -1)$
- <sup>2</sup>  $m_{AM} = 2$
- <sup>3</sup>  $y - (-1) = 2(x - 2)$

- [SQA] 13. In the diagram A is the point (7,0), B is (-3,-2) and C(-1,8). The median CE and the altitude BD intersect at J.
- (a) Find the equations of CE and BD.
- (b) Find the co-ordinates of J.



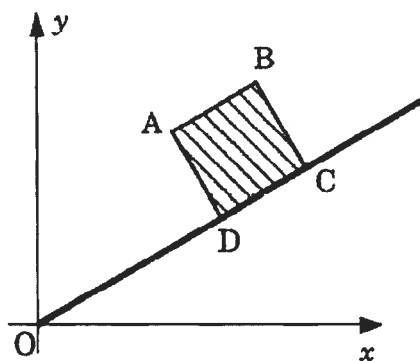
6  
2

part	marks	Unit	non-calc		calc		calc neut		Content Reference :		1.1
			C	A/B	C	A/B	C	A/B	Main	Additional	
(a)	6	1.1	6						1.1.7	1.1.9, 1.1.1	Source
(b)	2	1.1	2						1.1.10		1992 P1 qu.2

- <sup>1</sup>  $E = (2, -1)$
- <sup>2</sup>  $m_{CE} = -3$
- <sup>3</sup>  $y - (-1) = -3(x - 2)$  or  $y - 8 = -3(x - (-1))$
- <sup>4</sup>  $m_{AC} = -1$
- <sup>5</sup>  $m_{BD} = -1$
- <sup>6</sup>  $y - (-2) = 1(x - (-3))$
- <sup>7</sup> strat: attempt to solve simultaneously
- <sup>8</sup>  $J = (1, 2)$



- [SQA] 14. ABCD is a square. A is the point with coordinates (3,4) and ODC has equation  $y = \frac{1}{2}x$ .



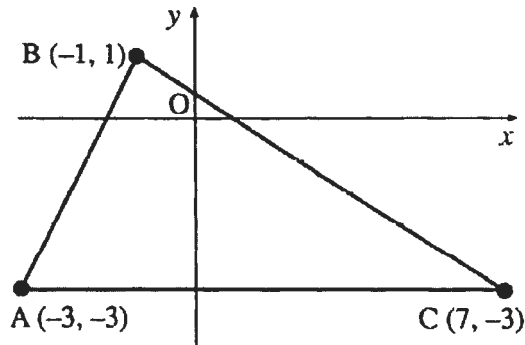
- (a) Find the equation of the line AD. (3)  
 (b) Find the coordinates of D. (3)  
 (c) Find the area of the square ABCD. (2)

part	marks	Unit	non-calc		calc		calc neut		Content Reference :		1.1
			C	A/B	C	A/B	C	A/B	Main	Additional	
(a)	3	1.1					3		1.1.9,	1.1.7	Source 1994 Paper 2 Qu.2
(b)	3	0.1					3		0.1		
(c)	2	1.1					2		1.1.2		

(a)	• <sup>1</sup>	using $m_1 m_2 = -1$
	• <sup>2</sup>	$m_{AD} = -2$
	• <sup>3</sup>	$y - 4 = -2(x - 3)$
(b)	• <sup>4</sup>	strategy for sim. equations
	• <sup>5</sup>	$2x + y = 10$ or equiv
	• <sup>6</sup>	(4, 2)
(c)	• <sup>7</sup>	strategy : find length of AD
	• <sup>8</sup>	5

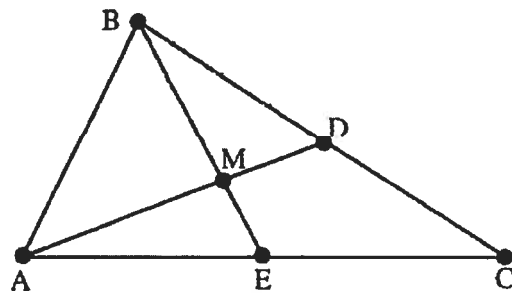
[SQA] 15. A triangle ABC has vertices A(-3, -3), B(-1, 1) and C(7, -3).

(a) Show that the triangle ABC is right-angled at B. (3)



(b) The medians AD and BE intersect at M.

- (i) Find the equations of AD and BE. (5)
- (ii) Hence find the coordinates of M. (3)



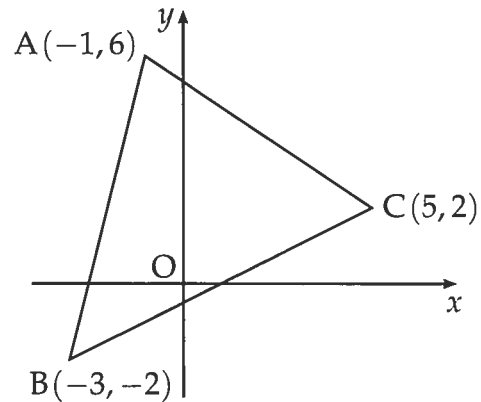
part	marks	Unit	non-calc		calc		calc neut		Content Reference :		1.1
			C	A/B	C	A/B	C	A/B	Main	Additional	
(a)	3	1.1					3		1.1.10		Source 1996 Paper 2 Qu.2
(b)i	5	1.1					5		1.1.10		
(b)ii	3	0.1					3		0.1		

(a)	• <sup>1</sup>	$m_{AB} = 2$
	• <sup>2</sup>	$m_{BC} = -\frac{1}{2}$
	• <sup>3</sup>	$m_{AB} \times m_{BC} = -1 \Rightarrow m_{AB} \perp m_{BC}$
(b)	• <sup>4</sup>	D = (3, -1) and E = (2, -3)
	• <sup>5</sup>	$m_{AD} = \frac{1}{3}$
	• <sup>6</sup>	AD: $y + 1 = \frac{1}{3}(x - 3)$ or equiv.
	• <sup>7</sup>	$m_{BE} = -\frac{4}{3}$
	• <sup>8</sup>	BE: $y - 1 = -\frac{4}{3}(x + 1)$ or equiv.
	• <sup>9</sup>	eg clear fractions
	• <sup>10</sup>	eg substitute
	• <sup>11</sup>	$x = 1, y = -\frac{5}{3}$

- [SQA] 16. Triangle ABC has vertices  $A(-1, 6)$ ,  $B(-3, -2)$  and  $C(5, 2)$ .

Find

- (a) the equation of the line  $p$ , the median from C of triangle ABC.
- (b) the equation of the line  $q$ , the perpendicular bisector of BC.
- (c) the coordinates of the point of intersection of the lines  $p$  and  $q$ .



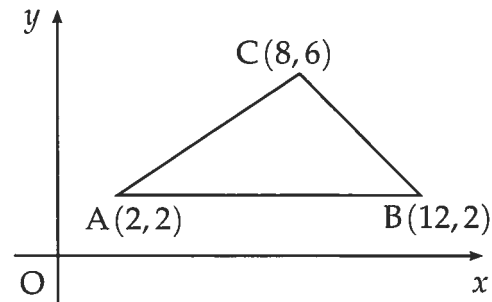
3  
4  
1

Part	Marks	Level	Calc.	Content	Answer	U1 OC1
(a)	3	C	CN	G7	$y = 2$	2002 P2 Q1
(b)	4	C	CN	G7	$y = -2x + 2$	
(c)	1	C	CN	G8	$(0, 2)$	

<ul style="list-style-type: none"> <li>•<sup>1</sup> ss: determine midpoint coordinates</li> <li>•<sup>2</sup> pd: determine gradient thro' 2 pts</li> <li>•<sup>3</sup> ic: state equation of straight line</li> <li>•<sup>4</sup> ss: determine midpoint coordinates</li> <li>•<sup>5</sup> pd: determine gradient thro' 2 pts</li> <li>•<sup>6</sup> ss: determine gradient perp. to •<sup>5</sup></li> <li>•<sup>7</sup> ic: state equation of straight line</li> <li>•<sup>8</sup> pd: process intersection</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>F = \text{mid}_{AB} = (-2, 2)</math></li> <li>•<sup>2</sup> <math>m_{FC} = 0</math> stated or implied by •<sup>3</sup></li> <li>•<sup>3</sup> equ. FC is <math>y = 2</math></li> <li>•<sup>4</sup> <math>M = \text{mid}_{BC} = (1, 0)</math></li> <li>•<sup>5</sup> <math>m_{BC} = \frac{1}{2}</math></li> <li>•<sup>6</sup> <math>m_{\perp} = -2</math></li> <li>•<sup>7</sup> <math>y - 0 = -2(x - 1)</math></li> <li>•<sup>8</sup> <math>(0, 2)</math></li> </ul>
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[SQA] 17. Triangle ABC has vertices A(2,2), B(12,2) and C(8,6).

- (a) Write down the equation of  $l_1$ , the perpendicular bisector of AB.
- (b) Find the equation of  $l_2$ , the perpendicular bisector of AC.
- (c) Find the point of intersection of lines  $l_1$  and  $l_2$ .
- (d) Hence find the equation of the circle passing through A, B and C.



1

4

1

2

Part	Marks	Level	Calc.	Content	Answer	U2 OC4
(a)	1	C	CN	G3, G7	$x = 7$	2001 P2 Q7
(b)	4	C	CN	G7	$3x + 2y = 23$	
(c)	1	C	CN	G8	(7, 1)	
(d)	2	A/B	CN	G8, G9, G10	$(x - 7)^2 + (y - 1)^2 = 26$	

- <sup>1</sup> ic: state equation of a vertical line
- <sup>2</sup> pd: process coord. of a midpoint
- <sup>3</sup> ss: find gradient of AC
- <sup>4</sup> ic: state gradient of perpendicular
- <sup>5</sup> ic: state equation of straight line
- <sup>6</sup> pd: find pt of intersection
- <sup>7</sup> ss: use standard form of circle equ.
- <sup>8</sup> ic: find radius and complete

- <sup>1</sup>  $x = 7$
- <sup>2</sup> midpoint = (5, 4)
- <sup>3</sup>  $m_{AC} = \frac{2}{3}$
- <sup>4</sup>  $m_{\perp} = -\frac{3}{2}$
- <sup>5</sup>  $y - 4 = -\frac{3}{2}(x - 5)$
- <sup>6</sup>  $x = 7, y = 1$
- <sup>7</sup>  $(x - 7)^2 + (y - 1)^2$
- <sup>8</sup>  $(x - 7)^2 + (y - 1)^2 = 26$

or

- <sup>7</sup>  $x^2 + y^2 - 14x - 2y + c = 0$
- <sup>8</sup>  $c = 24$