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

- $\bullet^1$ midpoint $= (5,1)$
- $\bullet^2$ $m_{AB} = \frac{2}{3}$
- $\bullet^3$ $m_{\perp} = -\frac{3}{2}$
- $\bullet^4$ $y-1 = -\frac{3}{2}(x-5)$

[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

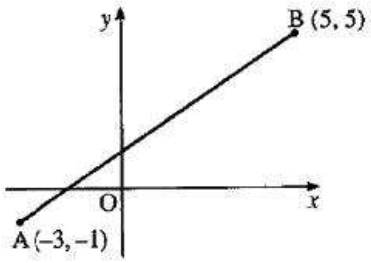
$\bullet^1$ ss: express in standard form $\bullet^2$ ic: interpret gradient $\bullet^3$ ic: state equation of straight line	$\bullet^1$ $y = -\frac{2}{3}x + \frac{5}{3}$ *stated or implied by* $\bullet^2$ $\bullet^2$ $m_{\text{line}} = -\frac{2}{3}$ *stated or implied by* $\bullet^3$ $\bullet^3$ $y-(-1)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

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

- $\bullet^1$ $m = -\frac{3}{2}$ stated or implied by $\bullet^2$
- $\bullet^2$ $y-(-5) = -\frac{3}{2}(x-3)$

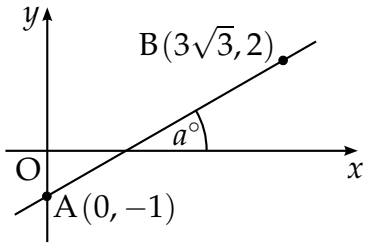
[SQA] 5. A and B are the points (–3, –1) and (5, 5).
Find the equation of
(a) the line AB 2
(b) the perpendicular bisector of AB. 3



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

•1 $m_{AB} = \frac{3}{4}$
•2 $y-5=\frac{3}{4}(x-5)$ *or* $y-(-1)=\frac{3}{4}(x-(-3))$
•3 $m_{\perp} = -\frac{4}{3}$
•4 midpoint $= (1,2)$
•5 $y-2=-\frac{4}{3}(x-1)$

[SQA] 6. Find the size of the angle $a°$ that the line joining the points $A(0,-1)$ and $B(3\sqrt{3},2)$ makes with the positive direction of the x-axis. 3

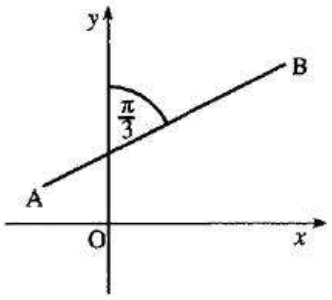


Part	Marks	Level	Calc.	Content	Answer	U1 OC1
	3	C	NC	G2	30	2000 P1 Q3

•1 ss: know how to find gradient or equ.
•2 pd: process
•3 ic: interpret exact value

•1 $\frac{2-(-1)}{3\sqrt{3}-0}$
•2 $\tan a$ = gradient *stated or implied by* •3
•3 $a = 30$

[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. 2

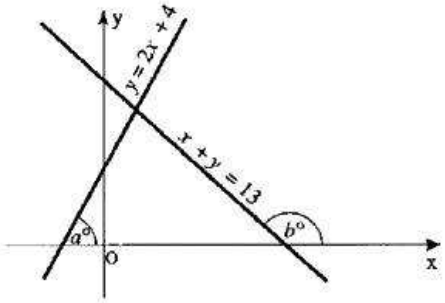


part	marks	Unit	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B	Content Reference : Main	Content Reference : Additional	1.1
	2	1.1						2	1.1.7		Source: 1999 P1 qu.7

- •1 "correct angle" $= \frac{\pi}{2} - \frac{\pi}{3}$
- •2 $\frac{1}{\sqrt{3}}$

[SQA] 8. The lines $y = 2x + 4$ and $x + y = 13$ make angles of $a°$ and $b°$ with the positive direction of the x-axis, as shown in the diagram.

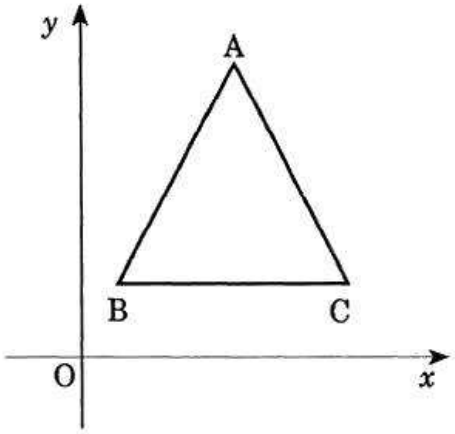
(a) Find the values of a and b. 4
(b) **Hence** find the acute angle between the two given lines. 1



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

- •1 $\tan a° = 2$
- •2 $a = 63.4°$
- •3 $\tan(180 - b) = 1$
- •4 $b = 135$
- •5 $180 - a - (180 - b)$ or equiv. to $b - a$

[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 C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B	Content Reference : Main	Additional	1.1
(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) •1 Calculate the length of the sides

•2 $AB = AC = \sqrt{3^2 + 6^2}$

(b) •3 knows to find equ. of an altitude

•4 $m_{AC} = -2$

•5 $m_{BE} = \frac{1}{2}$

•6 $y - 2 = \frac{1}{2}(x - 1)$

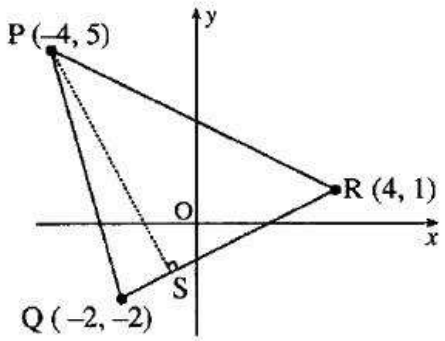
•7 $x = 4$ stated or implied

•8 knows how to find intersection

•9 $H = \left(4, \frac{7}{2}\right)$

•10 $DA = 6$ 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

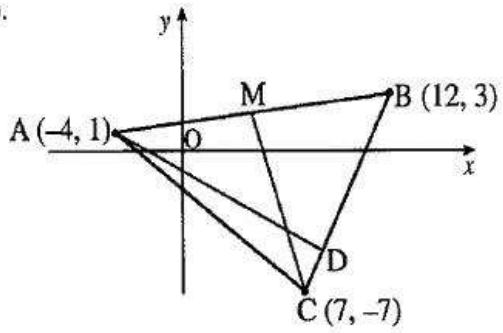


part	marks	Unit	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B	Content Reference : Main	Additional	1.1
.	3	1.1					3		1.1.1	1.1.9, 1.1.7	Source: 1997 P1 qu.1

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

[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. 3
(b) Find the equation of the altitude AD. 3
(c) Find the coordinates of the point of intersection of CM and AD. 3



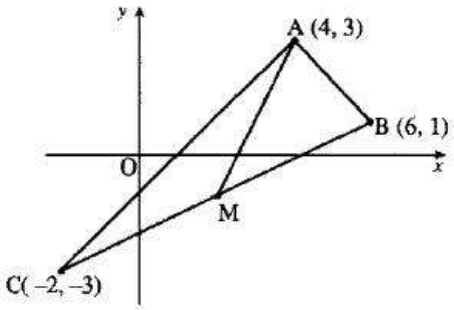
part	marks	Unit	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B	Content Reference : Main	Additional	1.1
(a)	3	1.1					3		1.1.7		Source
(b)	3	1.1					3		1.1.7	1.1.9	1999 Paper 2
(c)	3	0.1					3		0.1		Qu. 1

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

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

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

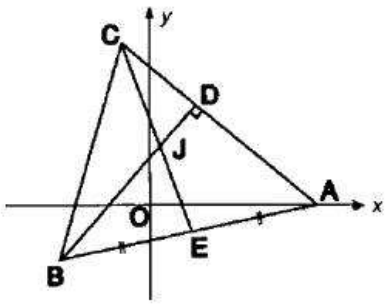
[SQA] 12. A triangle ABC has vertices A(4, 3), B(6, 1) and C(–2, –3) as shown in the diagram. Find the equation of AM, the median from A. 3



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

- •1 $M = (2, -1)$
- •2 $m_{AM} = 2$
- •3 $y - (-1) = 2(x - 2)$

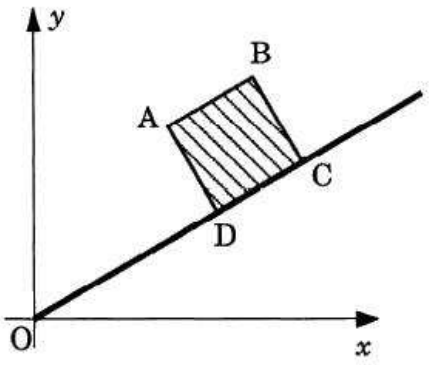
[SQA] 13. In the diagram A is the point (7,0), B is (–3,– 2) and C(–1,8). The median CE and the altitude BD intersect at J.
(a) Find the equations of CE and BD. 6
(b) Find the co-ordinates of J. 2



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

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

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

(a) •1 using $m_1 m_2 = -1$

•2 $m_{AD} = -2$

•3 $y - 4 = -2(x - 3)$

(b) •4 strategy for sim. equations

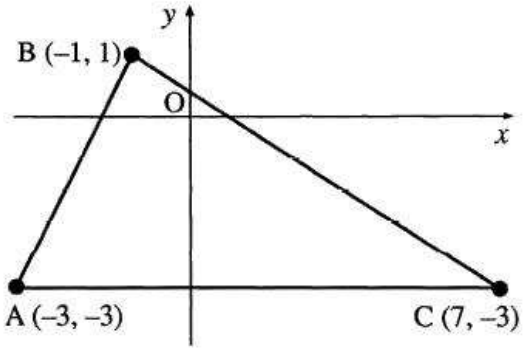
•5 $2x + y = 10$ or equiv

•6 (4,2)

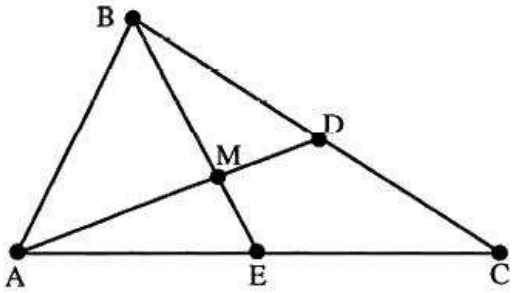
(c) •7 strategy : find length of AD

•8 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
(*b*)i	5	1.1					5		1.1.10		1996 Paper 2
(b)ii	3	0.1					3		0.1		Qu.2

(*a*) •1 $m_{AB} = 2$

•2 $m_{BC} = -\frac{1}{2}$

•3 $m_{AB} \times m_{BC} = -1 \Rightarrow m_{AB} \perp m_{BC}$

(*b*) •4 D = (3, –1) *and* E = (2, –3)

•5 $m_{AD} = \frac{1}{3}$

•6 AD: $y + 1 = \frac{1}{3}(x - 3)$ *or equiv.*

•7 $m_{BE} = -\frac{4}{3}$

•8 BE: $y - 1 = -\frac{4}{3}(x + 1)$ *or equiv.*

•9 *eg* clear fractions

•10 *eg* substitute

•11 $x = 1,\ y = -\frac{5}{3}$

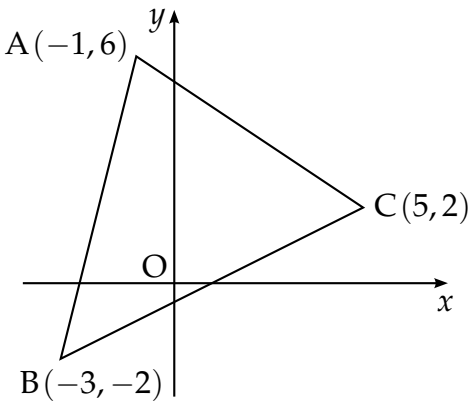
[SQA] 16. Triangle ABC has vertices $A(-1,6)$, $B(-3,-2)$ and $C(5,2)$.

Find

(a) the equation of the line p, the median from C of triangle ABC. **3**

(b) the equation of the line q, the perpendicular bisector of BC. **4**

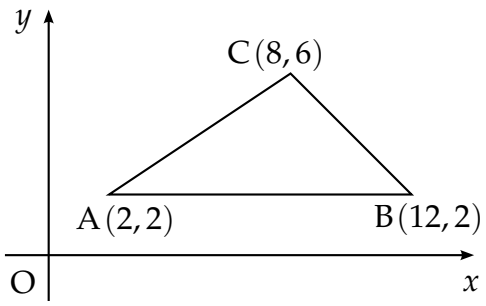
(c) the coordinates of the point of intersection of the lines p and q. **1**



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	$(0,2)$	

$\bullet^1$ ss: determine midpoint coordinates	$\bullet^1$ $F = \text{mid}_{AB} = (-2,2)$
$\bullet^2$ pd: determine gradient thro' 2 pts	$\bullet^2$ $m_{FC} = 0$ *stated or implied by* $\bullet^3$
$\bullet^3$ ic: state equation of straight line	$\bullet^3$ equ. FC is $y = 2$
$\bullet^4$ ss: determine midpoint coordinates	$\bullet^4$ $M = \text{mid}_{BC} = (1,0)$
$\bullet^5$ pd: determine gradient thro' 2 pts	$\bullet^5$ $m_{BC} = \frac{1}{2}$
$\bullet^6$ ss: determine gradient perp. to $\bullet^5$	$\bullet^6$ $m_{\perp} = -2$
$\bullet^7$ ic: state equation of straight line	$\bullet^7$ $y - 0 = -2(x - 1)$
$\bullet^8$ pd: process intersection	$\bullet^8$ $(0,2)$

[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. **1**

(*b*) Find the equation of l_2, the perpendicular bisector of AC. **4**

(*c*) Find the point of intersection of lines l_1 and l_2. **1**

(*d*) Hence find the equation of the circle passing through A, B and C. **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	$(x-7)^2 + (y-1)^2 = 26$	

•^{1} ic: state equation of a vertical line	•^{1} $x = 7$
•^{2} pd: process coord. of a midpoint	•^{2} midpoint $= (5, 4)$
•^{3} ss: find gradient of AC	•^{3} $m_{AC} = \frac{2}{3}$
•^{4} ic: state gradient of perpendicular	•^{4} $m_\perp = -\frac{3}{2}$
•^{5} ic: state equation of straight line	•^{5} $y - 4 = -\frac{3}{2}(x - 5)$
•^{6} pd: find pt of intersection	•^{6} $x = 7, y = 1$
•^{7} ss: use standard form of circle equ.	•^{7} $(x-7)^2 + (y-1)^2$
•^{8} ic: find radius and complete	•^{8} $(x-7)^2 + (y-1)^2 = 26$
	or
	•^{7} $x^2 + y^2 - 14x - 2y + c = 0$
	•^{8} $c = 24$

[SQA] 18. The vertices of a triangle are $P(-1,1)$, $Q(2,1)$ and $R(-6,2)$. Find the equation of the altitude of triangle PQR, drawn from P. **3**

part	marks	Unit	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B	Content Reference: Main	Additional	1.1
.	3	1.1					3		1.1.7	1.1.9	Source: 1989 P1 qu.1

- •1 $m_{QR} = -\frac{1}{8}$
- •2 $m_{\perp} = 8$
- •3 $y-(-1) = 8(x-(-1))$

[SQA] 19. Find the equation of the median AD of triangle ABC where the coordinates of A, B and C are $(-2,3)$, $(-3,-4)$ and $(5,2)$ respectively. **3**

part	marks	Unit	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B	Content Reference: Main	Additional	1.1
.	3	1.1					3		1.1.7	1.1.1	Source: 1995 P1 qu.5

- •1 D = (1, −1)
- •2 use A and D to get $m_{AD} = -\frac{4}{3}$
- •3 $y-3 = -\frac{4}{3}(x--2)$

OR

- •1 for showing triangle isosceles
- •2 $m_{BC} = \frac{3}{4}$ giving $m_{AD} = -\frac{4}{3}$
- •3 $y-3 = -\frac{4}{3}(x--2)$

[END OF WRITTEN QUESTIONS]