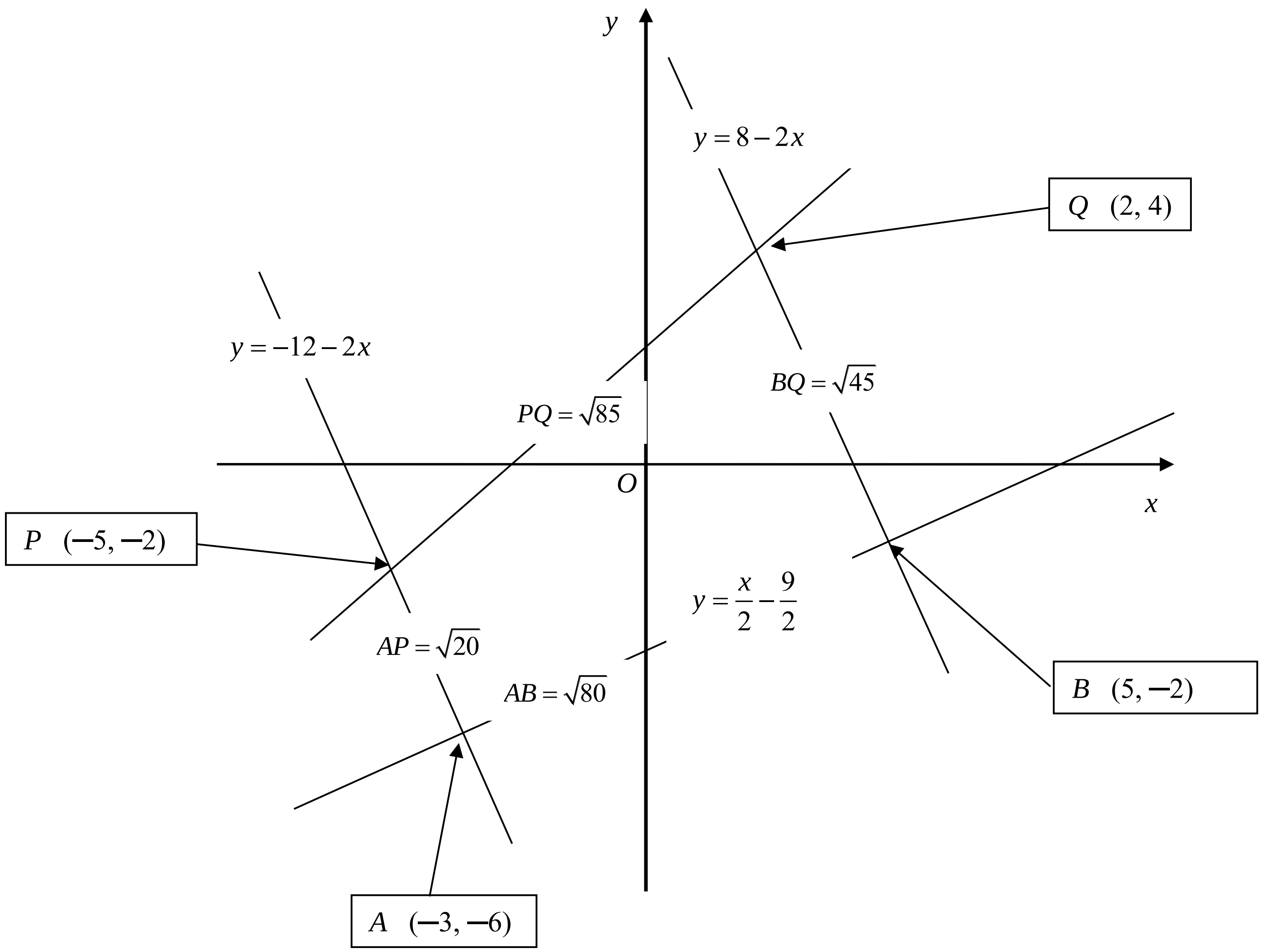
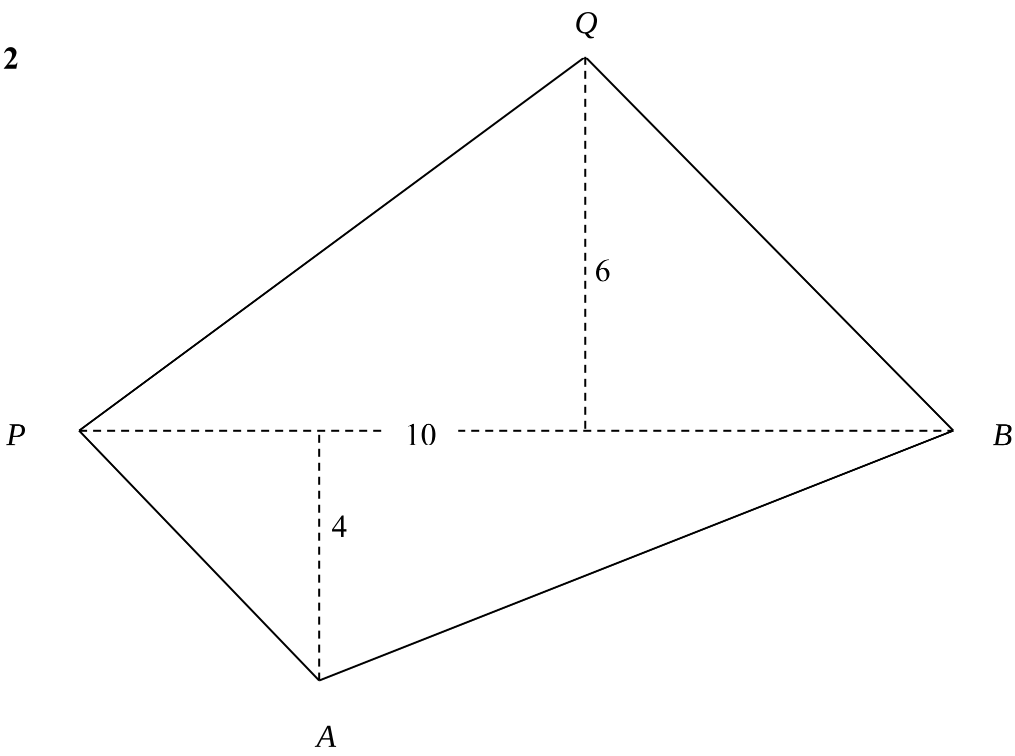
| Question number | Scheme | Marks |
|---|---|---|
| 9 (a) | $\dfrac{y--6}{-2--6}=\dfrac{x--3}{5--3}\quad\Rightarrow y=\dfrac{1}{2}x-\dfrac{9}{2}$ oe | M1A1A1 (3) |
| (b) | Gradient of perpendicular $=-2$ | B1 |
| | $y--6=-2(x--3)\Rightarrow -2=-2\times x-12\Rightarrow x=-5$ * | M1A1 cso (3) |
| (c) | Equation of perpendicular to $l$ through $B$ | B1 |
| | $y--2=-2\left(x-5\right)\Rightarrow y=-2x+8$ | |
| | $\sqrt{85}=\sqrt{\left(f--2\right)^2+\left(e--5\right)^2}$ | M1 |
| | $85=\left(\left(-2e+8\right)+2\right)^2+\left(e+5\right)^2\Rightarrow 0=5e^2-30e+40$ | M1 |
| | $\Rightarrow\left(e-4\right)\left(e-2\right)=0\Rightarrow e=2,\quad\left(e=4\right)$ | M1A1 |
| | $f=-2\times 2+8\Rightarrow f=4$ Coordinates of $Q$ are (2, 4) | A1 (6) |
| | **ALT** | |
| | $-2=\dfrac{f+2}{e-5}\Rightarrow f=8-2e$ | [B1 |
| | $\sqrt{85}=\sqrt{\left(f--2\right)^2+\left(e--5\right)^2}$ | M1 |
| | $85=\left(\left(-2e+8\right)+2\right)^2+\left(e+5\right)^2\Rightarrow 0=5e^2-30e+40$ | M1 |
| | $\Rightarrow\left(e-4\right)\left(e-2\right)=0\Rightarrow e=2,\quad\left(e=4\right)$ | M1A1 |
| | $f=8-2\times 2=4$ Coordinates of $Q$ are $\left(2,\ 4\right)$ | A1 (6)] |
| (d) | Area of $ABQP$ | |
| | $AP=\sqrt{\left(-3--5\right)^2+\left(-6--2\right)^2}=\sqrt{20}$ | |
| | $AB=\sqrt{\left(-3-5\right)^2+\left(-6--2\right)^2}=\sqrt{80}$ | |
| | $BQ=\sqrt{\left(2-5\right)^2+\left(4--2\right)^2}=\sqrt{45}$ | M1 (either) A1 (all) |
| | Shape is a trapezium | |
| | Area $=\dfrac{1}{2}\left(\sqrt{80}\right)\left(\sqrt{20}+\sqrt{45}\right)=50$ | M1A1 (4) |
| | **ALT** | |
| | $\dfrac{1}{2}\begin{pmatrix}-3 & 5 & 2 & -5 & -3\\ -6 & -2 & 4 & -2 & -6\end{pmatrix}=$ | {M1A1 |
| | $\dfrac{1}{2}\left(\left(6+20-4+30\right)-\left(-30-4-20+6\right)\right)=50$ | M1A1} (4) |
| | | [16] |

| Additional Notes | | |
|---|---|---|
| **Part** | **Mark** | **Guidance** |
| (a) | M1 | Either uses the correct formula substituting in the correct values of $y$ and $x$ to form an equation,<br>OR finds the gradient of $l$ using $m=\dfrac{y_1-y_2}{x_1-x_2}$ and then uses either<br>$y-y_1=m\left(x-x_1\right)$ or $y=mx+c$<br>If they use $y=mx+c$ they must reach a value of $c$ for the award of this mark.<br>Allow one sign error. |
| | A1 | For the correct equation of the line un-simplified. |
| | A1 | For $y=\dfrac{1}{2}x-\dfrac{9}{2}$ oe |
| (b) | B1 | For the gradient of the perpendicular of $-2$ |
| | M1 | For a complete method to find the value of $k$.<br>Finds the equation of the line through $A$ and $P$ and subs in $-2$ to find the value of $k$.<br>$\left\{y--6=-2(x--3)\Rightarrow -2=-2\times x-12\Rightarrow x=-5\right\}$ |
| | A1 | $k=-5$ Accept $x=-5$<br>**Note: This is a show question** – Every step must be correct for the award of this mark. |
| **ALT Uses the gradient of *AP*** | | |
| (b) | B1 | For the gradient of the perpendicular of $-2$ seen explicitly or used correctly |
| | M1 | For a complete method to find to find the value of $k$ using gradients.<br>$-2=\dfrac{-2--6}{k--3}\Rightarrow -2k-6=4\Rightarrow k=\left(-5\right)$ |
| | A1 | $k=-5$<br>**Note: This is a show question** – Every step must be correct for the award of this mark. |
| (c) | B1 | **Either** writes down the equation of the line $BQ$ using the coordinates of $B$<br>$y--2=-2\left(x-5\right)\Rightarrow y=-2x+8\Rightarrow\left(f=-2e+8\right)$<br>**Or** writes down an expression for the gradient of $BQ$ using the coordinates of $B$<br>$-2=\dfrac{f+2}{e-5}\Rightarrow f=8-2e$ |
| | M1 | Uses Pythagoras theorem with the coordinates of $P$ and $Q$ to form<br>$\sqrt{85}=\sqrt{\left(f--2\right)^2+\left(e--5\right)^2}$ or $85=\left(f--2\right)^2+\left(e--5\right)^2$ |
| | M1 | Substitutes an expression for $f$ to form a 3TQ in $e$<br>$\left(0=5e^2-30e+40\right)$ |
| | M1 | Solves their 3TQ by any method (see general guidance) to achieve two values |
| | A1 | $e=2$ (and 4) — Accept coordinates. |
| | A1 | $f=4$ [$f>0$] |
| **ALT** | | |

| | | |
|---|---|---|
| (c) | B1 | **Either** writes down the equation of the line $BQ$ using the coordinates of $B$ $y--2=-2(x-5)\Rightarrow y=-2x+8\Rightarrow(f=-2e+8)$ **Or** writes down an expression for the gradient of $BQ$ using the coordinates of $B$ $-2=\dfrac{f+2}{e-5}\Rightarrow f=8-2e$ |
| | M1 | Uses Pythagoras theorem with the coordinates of $P$ and $Q$ to form $\sqrt{85}=\sqrt{(f--2)^2+(e--5)^2}$ |
| | M1 | Substitutes an expression for $e$ to form an equation in $f$ $85=(f+2)^2+\left(9-\dfrac{f}{2}\right)^2\Rightarrow 0=5f^2-20f$ oe |
| | M1 | Solves their 2TQ equation |
| | A1 | $f=4$ |
| | A1 | $e=2$ $(f>0)$ |
| **Any attempt using ratios – please send to review.** | | |
| (d) | M1 | Uses Pythagoras theorem to find the lengths of $AB$ **or** $AP$ **or** $BQ$ $AB=\sqrt{(-3-5)^2+(-6--2)^2}=(\sqrt{80})$, $AP=\sqrt{('5'--3)^2+(-2--6)^2}=(\sqrt{20})$ $BQ=\sqrt{(5-2)^2+(-2-4)^2}=(\sqrt{45})$ |
| | A1 | $AB=\sqrt{80}$, $AP=\sqrt{20}$ and $BQ=\sqrt{45}$ **(ALL THREE)** |
| | M1 | Shape is a trapezium so uses correct formula, or breaks down into a triangle and rectangle to find an area $A=\dfrac{1}{2}(\sqrt{'80'})(\sqrt{'20'}+\sqrt{'45'})=(50)$ **or** Area of rectangle = $\sqrt{'20'}\times\sqrt{'80'}='40'$ Area of triangle = $\dfrac{1}{2}(\sqrt{'45'}-\sqrt{'20'})\times\sqrt{'80'}='10'$ Total area = (50) |
| | A1 | $A=50$ |
| **ALT 1** | | |
| (d) | M1 | Uses correct formula for the area of the quadrilateral using determinants using their values of $(e, f)$ There must be 5 sets of coordinates in either clockwise or anticlockwise order starting and finishing at the same coordinate |
| | A1 | For the correct formula with the correct coordinates. |
| | M1 | For processing the calculation correctly. |
| | A1 | $A=50$ If they leave the final answer as $A=-50$ withhold this mark |
| **ALT 2** | | |
| (d) | M1 | For the area of either $APB$ or $PBQ$ _ $APB=\dfrac{6\times10}{2}=30$ $PBQ=\dfrac{4\times10}{2}=20$ |
| | A1 | For both correct areas of triangles $APB$ and $PBQ$ |
| | M1 | For adding together their areas of triangles $APB$ and $PBQ$ |
| | A1 | 50 |


y
$y = 8 - 2x$
Q (2, 4)
$y = -12 - 2x$
$BQ = \sqrt{45}$
$PQ = \sqrt{85}$
O
x
P (−5, −2)
$y = \frac{x}{2} - \frac{9}{2}$
$AP = \sqrt{20}$
$AB = \sqrt{80}$
B (5, −2)
A (−3, −6)

**ALT 2**


Q
6
P
10
B
4
A