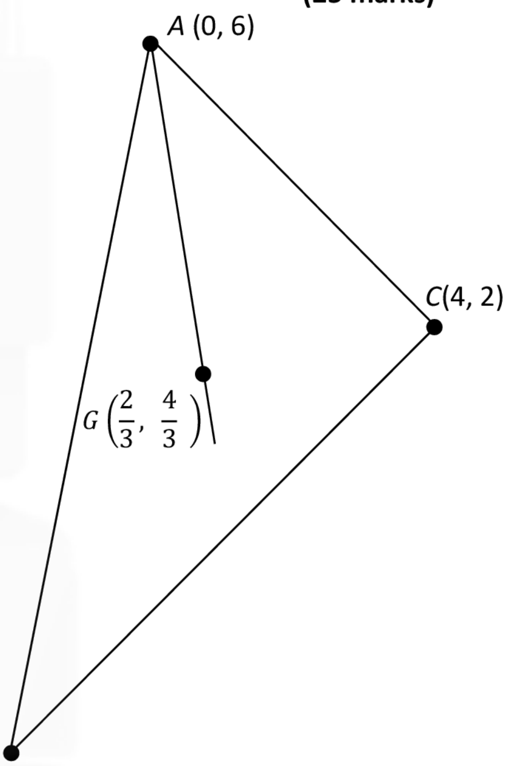
Question 3 **(25 marks)**

ABC is a triangle where the co-ordinates of *A* and *C* are (0, 6) and (4, 2) respectively.
$G\left(\frac{2}{3}, \frac{4}{3}\right)$ is the centroid of the triangle *ABC*.
AG intersects *BC* at the point *P*.
$|AG| : |GP| = 2 : 1$.



(a) Find the co-ordinates of *P*.

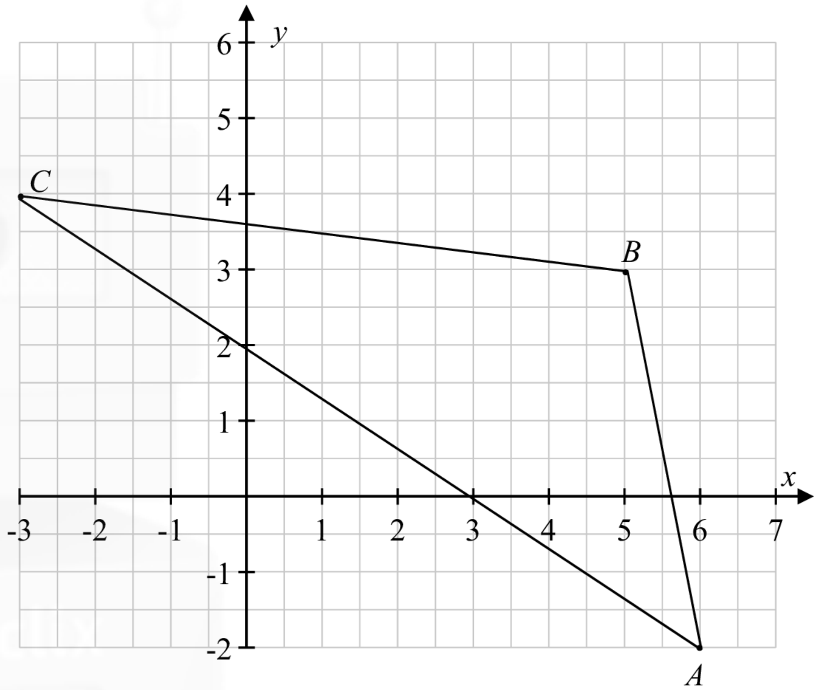
(b) Find the co-ordinates of *B*.

(c) Prove that *C* is the orthocentre of the triangle *ABC*.

Question 2

The points $A(6, -2)$, $B(5, 3)$ and $C(-3, 4)$ are shown on the diagram.

(a) Find the equation of the line through B which is perpendicular to AC.



(b) Use your answer to part **(a)** above to find the co-ordinates of the orthocentre of the triangle ABC.

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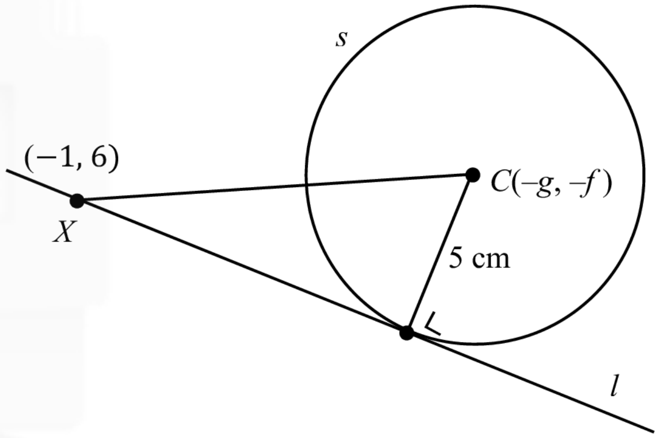
Question 3

A point X has co-ordinates $(-1, 6)$ and the slope of the line XC is $\frac{1}{7}$.

(a) Find the equation of XC. Give your answer in the form $ax + by + c = 0$, where $a, b, c \in \mathbb{Z}$.



(b) C is the centre of a circle s, of radius 5 cm. The line l: $3x + 4y - 21 = 0$ is a tangent to s and passes through X, as shown. Find the equation of one such circle s.

Question 3 **(25 marks)**

(a) The co-ordinates of two points are $A(4,\ -1)$ and $B(7,\ t)$.

The line $l_1: 3x-4y-12=0$ is perpendicular to AB. Find the value of t.

(b) Find, in terms of k, the distance between the point $P(10,\ k)$ and l_1.

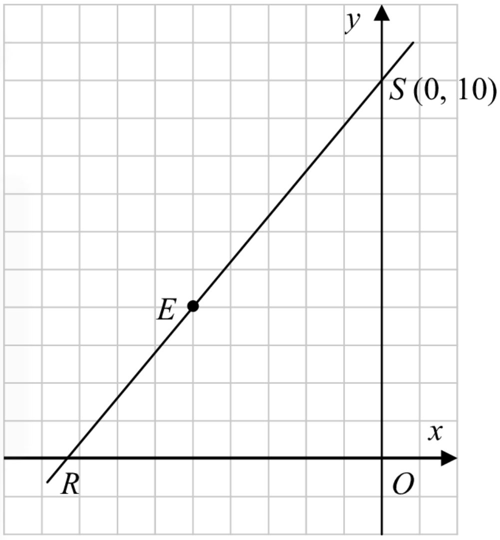
(c) $P(10,\ k)$ is on a bisector of the angles between the lines l_1 and $l_2: 5x+12y-20=0$.

(i) Find the possible values of k.

(ii) If $k > 0$, find the distance from P to l_1.

Question 5

The line RS cuts the x-axis at the point R and the y-axis at the point $S(0, 10)$, as shown. The area of the triangle ROS, where O is the origin, is $\frac{125}{3}$.



(a) Find the co-ordinates of R.

(b) Show that the point $E(-5, 4)$ is on the line RS.

(c) A second line $y = mx + c$, where m and c are positive constants, passes through the point E and again makes a triangle of area $\frac{125}{3}$ with the axes. Find the value of m and the value of c.

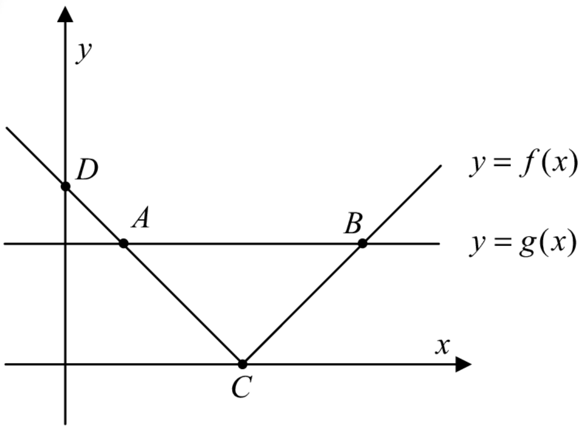
Question 4 **(25 marks)**

(a) Solve the simultaneous equations:

$$2x + 8y - 3z = -1$$
$$2x - 3y + 2z = 2$$
$$2x + y + z = 5.$$

(b) The graphs of the functions $f : x \mapsto |x-3|$ and $g : x \mapsto 2$ are shown in the diagram.

(i) Find the co-ordinates of the points A, B, C and D.



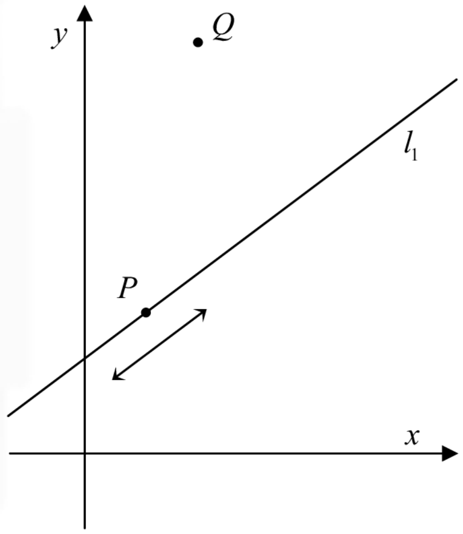
$A = (\quad , \quad)$ $B = (\quad , \quad)$

$C = (\quad , \quad)$ $D = (\quad , \quad)$

(ii) Hence, or otherwise, solve the inequality $|x-3| < 2$.

Question 3 **(25 marks)**

(a) Show that, for all $k \in \mathbb{R}$, the point $P(4k-2, 3k+1)$ lies on the line $l_1 : 3x - 4y + 10 = 0$.



(b) The line l_2 passes through P and is perpendicular to l_1. Find the equation of l_2, in terms of k.

(c) Find the value of k for which l_2 passes through the point $Q(3, 11)$.

(d) Hence, or otherwise, find the co-ordinates of the foot of the perpendicular from Q to l_1.

Question 3 **(25 marks)**

The equations of six lines are given:

Line	Equation
h	$x = 3 - y$
i	$2x - 4y = 3$
k	$y = -\frac{1}{4}(2x - 7)$
l	$4x - 2y - 5 = 0$
m	$x + \sqrt{3}y - 10 = 0$
n	$\sqrt{3}x + y - 10 = 0$

(a) Complete the table below by matching each description given to one or more of the lines.

Description	**Line(s)**
A line with a slope of 2.	
A line which intersects the y-axis at $(0, -2\frac{1}{2})$.	
A line which makes equal intercepts on the axes.	
A line which makes an angle of 150° with the positive sense of the x-axis.	
Two lines which are perpendicular to each other.	

(b) Find the acute angle between the lines m and n.

Question 1 **(25 marks)**

(a) Given the co-ordinates of the vertices of a quadrilateral *ABCD*, describe **three** different ways to determine, using co-ordinate geometry techniques, whether the quadrilateral is a parallelogram.

method 1:

method 2:

method 3:

(b) Using **one** of the methods you described, determine whether the quadrilateral with vertices (–4, –2), (21, –5), (8, 7) and (–17, 10) is a parallelogram.

Question 1 **(25 marks)**

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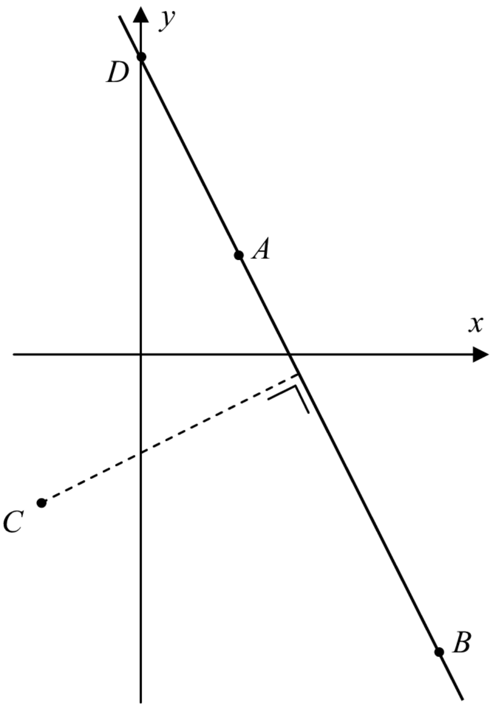
(b) Using **one** of the methods you described, determine whether the quadrilateral with vertices $(-4, -2)$, $(21, -5)$, $(8, 7)$ and $(-17, 10)$ is a parallelogram.

Question 3 **(25 marks)**

The co-ordinates of three points A, B, and C are: $A(2, 2)$, $B(6, -6)$, $C(-2, -3)$.
(See diagram on facing page.)

(a) Find the equation of AB.

(b) The line AB intersects the y-axis at D.
Find the coordinates of D.



(c) Find the perpendicular distance from C to AB.

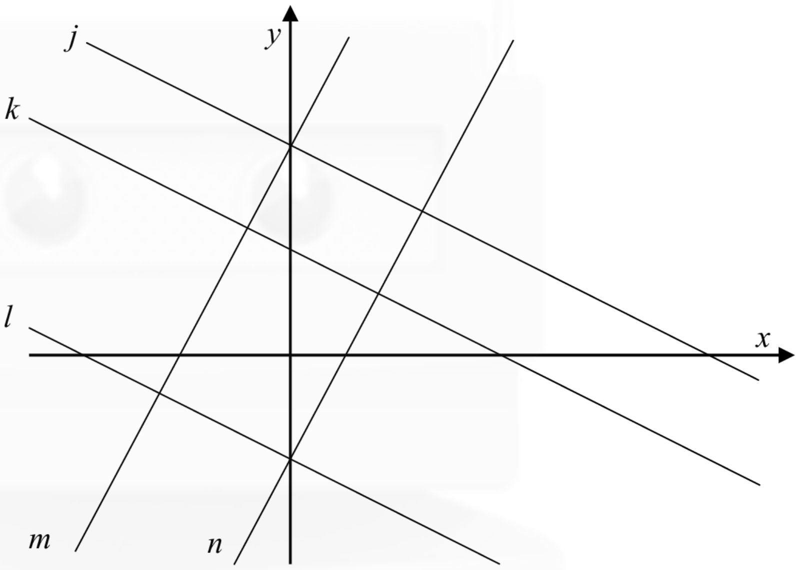
(d) Hence, find the area of the triangle ADC.

Question 4 **(25 marks)**

(a) Write down the equation of the circle with centre (–3, 2) and radius 4.

(b) A circle has equation $x^2 + y^2 - 2x + 4y - 15 = 0$.
Find the values of m for which the line $mx + 2y - 7 = 0$ is a tangent to this circle.

In the co-ordinate diagram shown, the lines j, k, and l are parallel, and so are the lines m and n.
The equations of four of the five lines are given in the table below.



Equation	Line
$x+2y=-4$	
$2x-y=-4$	
$x+2y=8$	
$2x-y=2$	

(a) Complete the table, by matching four of the lines to their equations.

(b) Hence, insert scales on the x-axis and y-axis.

(c) Hence, find the equation of the remaining line, given that its x-intercept and y-intercept are both integers.