Equations, inequalities and graphs – 2021 O Level Additional Math

1. Nov/2021/Paper_12/No.5

Find the possible values of the constant c for which the line $y = c$ is a tangent to the curve $y = 5\sin\frac{x}{3} + 4$. [3]

2. Nov/2021/Paper_13/No.8

The curves $y = x^2 + x - 1$ and $2y = x^2 + 6x - 2$ intersect at the points A and B.

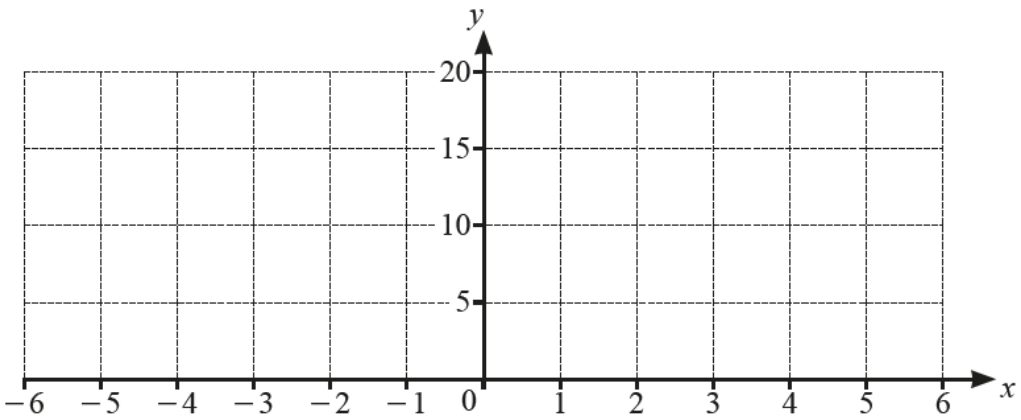
(a) Show that the mid-point of the line AB is (2, 9). [5]

The line l is the perpendicular bisector of AB.

(b) Show that the point C (12, 7) lies on the line l. [3]

(c) The point D also lies on l, such that the distance of D from AB is two times the distance of C from AB. Find the coordinates of the two possible positions of D. [4]

3. Nov/2021/Paper_22/No.1



(a) On the axes, draw the graphs of $y = 5 + |3x - 2|$ and $y = 11 - x$. [4]

(b) Using the graphs, or otherwise, solve the inequality $11 - x < 5 + |3x - 2|$. [2]

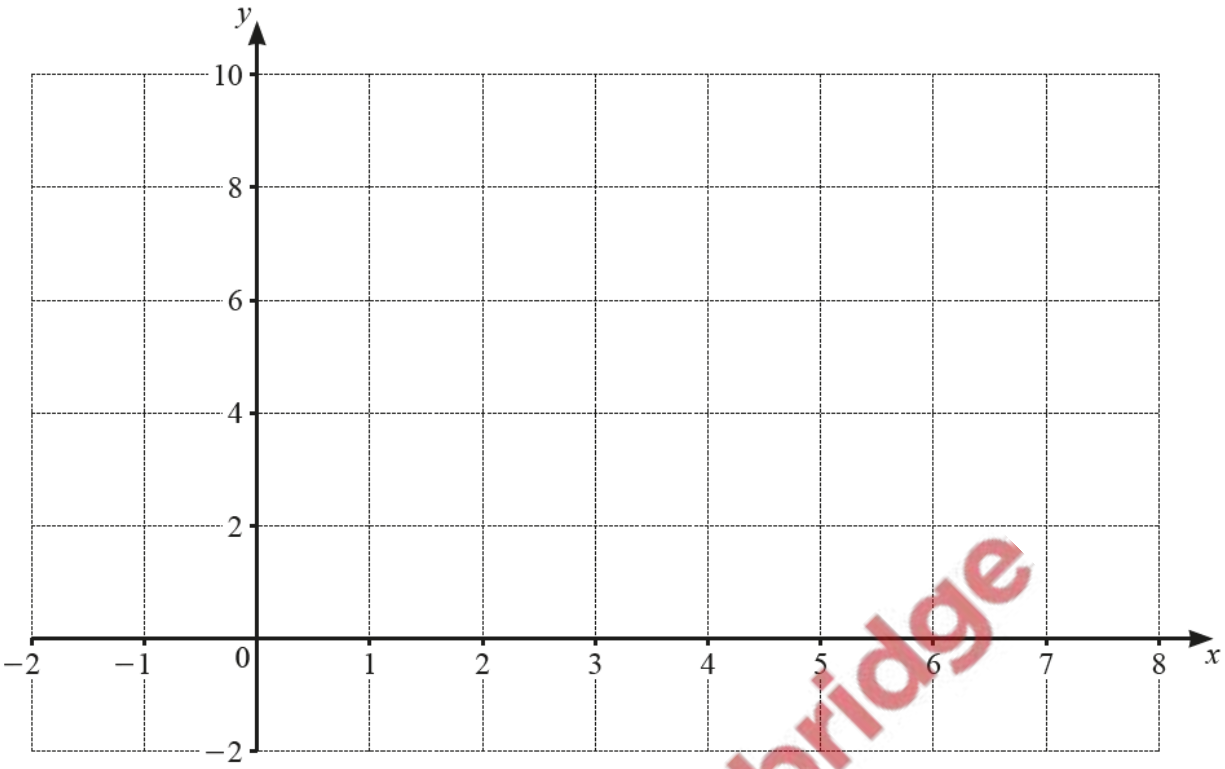
4. Nov/2021/Paper_22/No.9

(a) Find the equation of the normal to the curve $y = x^3 + x^2 - 4x + 6$ at the point $(1, 4)$. [5]

(b) **DO NOT USE A CALCULATOR IN THIS PART OF THE QUESTION.**

Find the exact x-coordinate of each of the two points where the normal cuts the curve again. [5]

5. Nov/2021/Paper_23/No.1

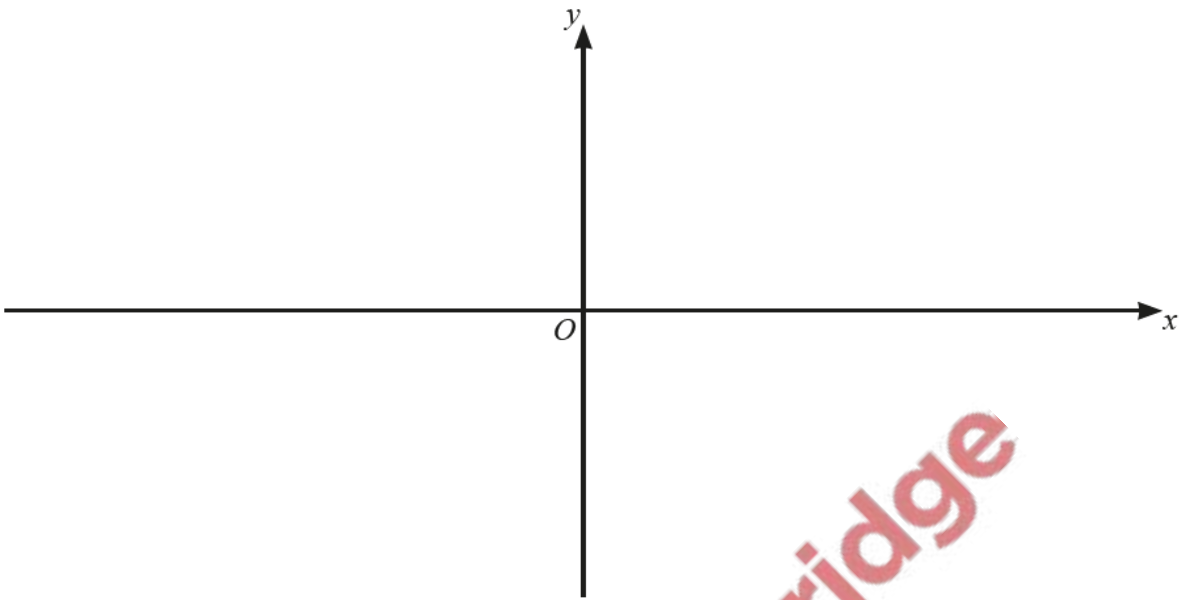


(a) On the axes draw the graphs of $y = |x - 5|$ and $y = 6 - |2x - 7|$. [4]

(b) Use your graphs to solve the inequality $|x - 5| > 6 - |2x - 7|$. [2]

6. June/2021/Paper_11/No.1

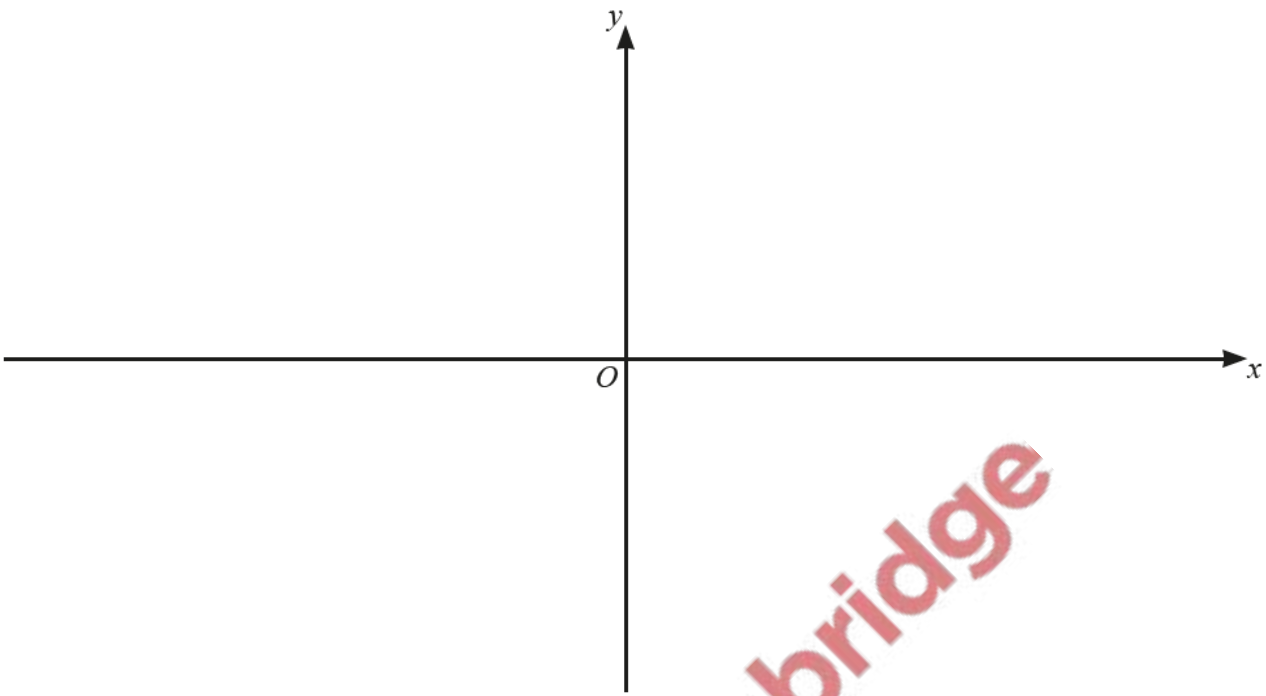
(a) On the axes, sketch the graph of $y = 5(x+1)(3x-2)(x-2)$, stating the intercepts with the coordinate axes. [3]



(b) Hence find the values of x for which $5(x+1)(3x-2)(x-2) > 0$. [2]

7. June/2021/Paper_12/No.2

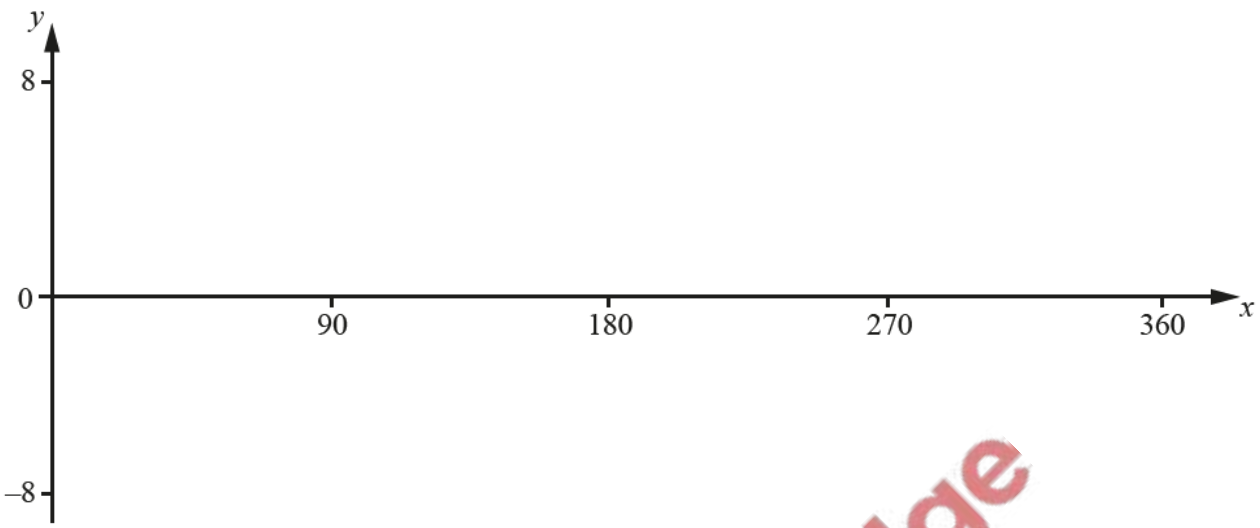
(a) On the axes, sketch the graph of $y = |4 - 3x|$, stating the intercepts with the coordinate axes. [2]



(b) Solve the inequality $|4 - 3x| \geqslant 7$. [3]

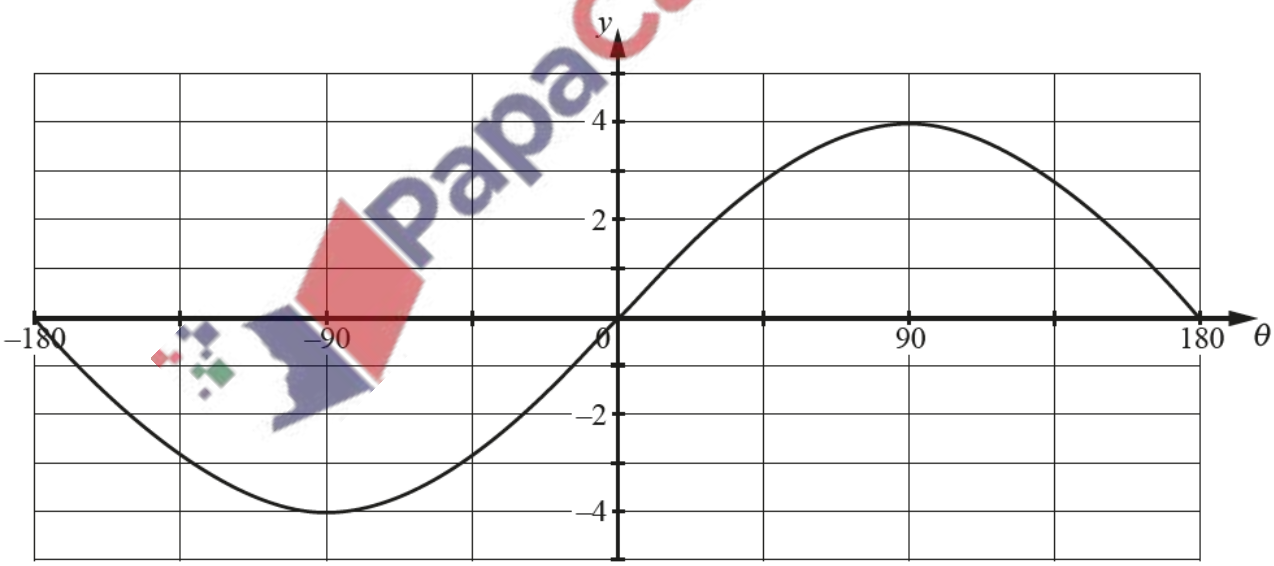
8. June/2021/Paper_14/No.1

(a) On the axes below, sketch the graph of $y = 6\cos 2x - 1$ for $0° \leqslant x \leqslant 360°$.



[3]

(b) The graph of $y = a + b\sin c\theta$ for $-180° \leqslant \theta \leqslant 180°$ is shown below.

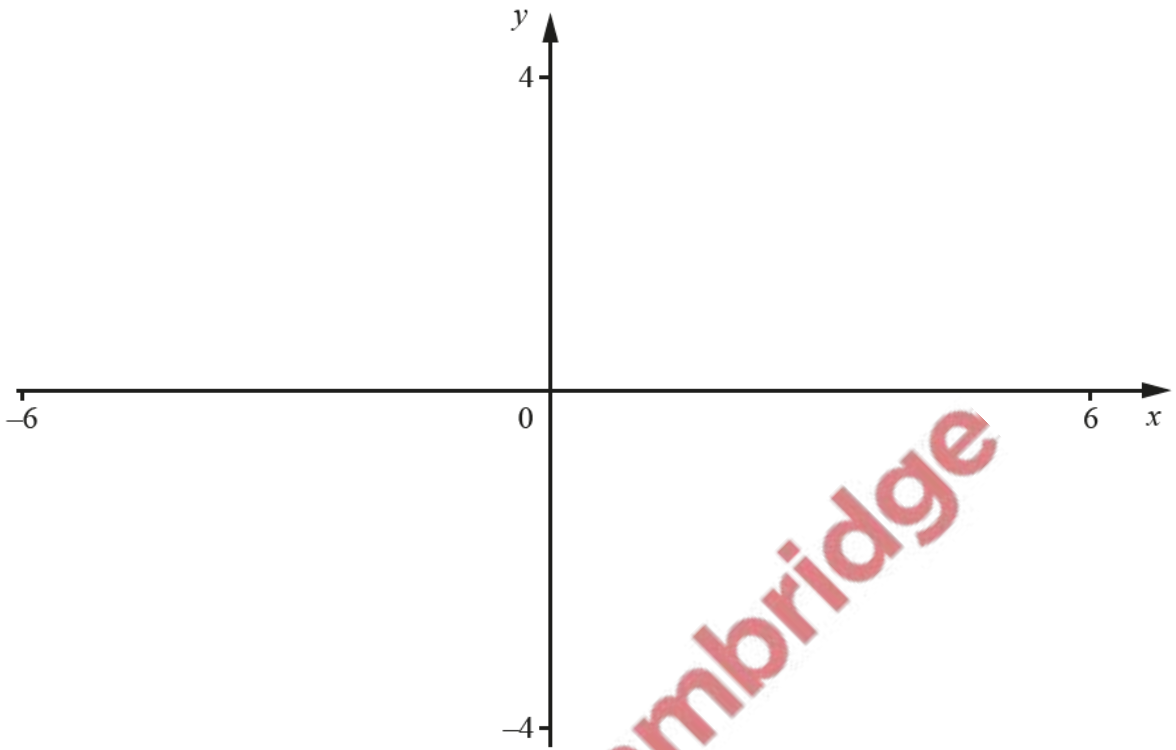


Write down the value of each of the constants a, b and c. [2]

$a =$ ..... $b =$ ..... $c =$ .....

9. June/2021/Paper_14/No.2

(a) On the axes below, sketch the graphs of $y = |x - 3|$ and $y = \left|\frac{2}{5}x\right|$, giving the coordinates of the points where the graphs meet the axes. [3]



(b) Solve the equation $\left|\frac{2}{5}x\right| = |x - 3|$. [2]

10. June/2021/Paper_21/No.3

(a) Solve the inequality $|4x-1|>9$. [3]

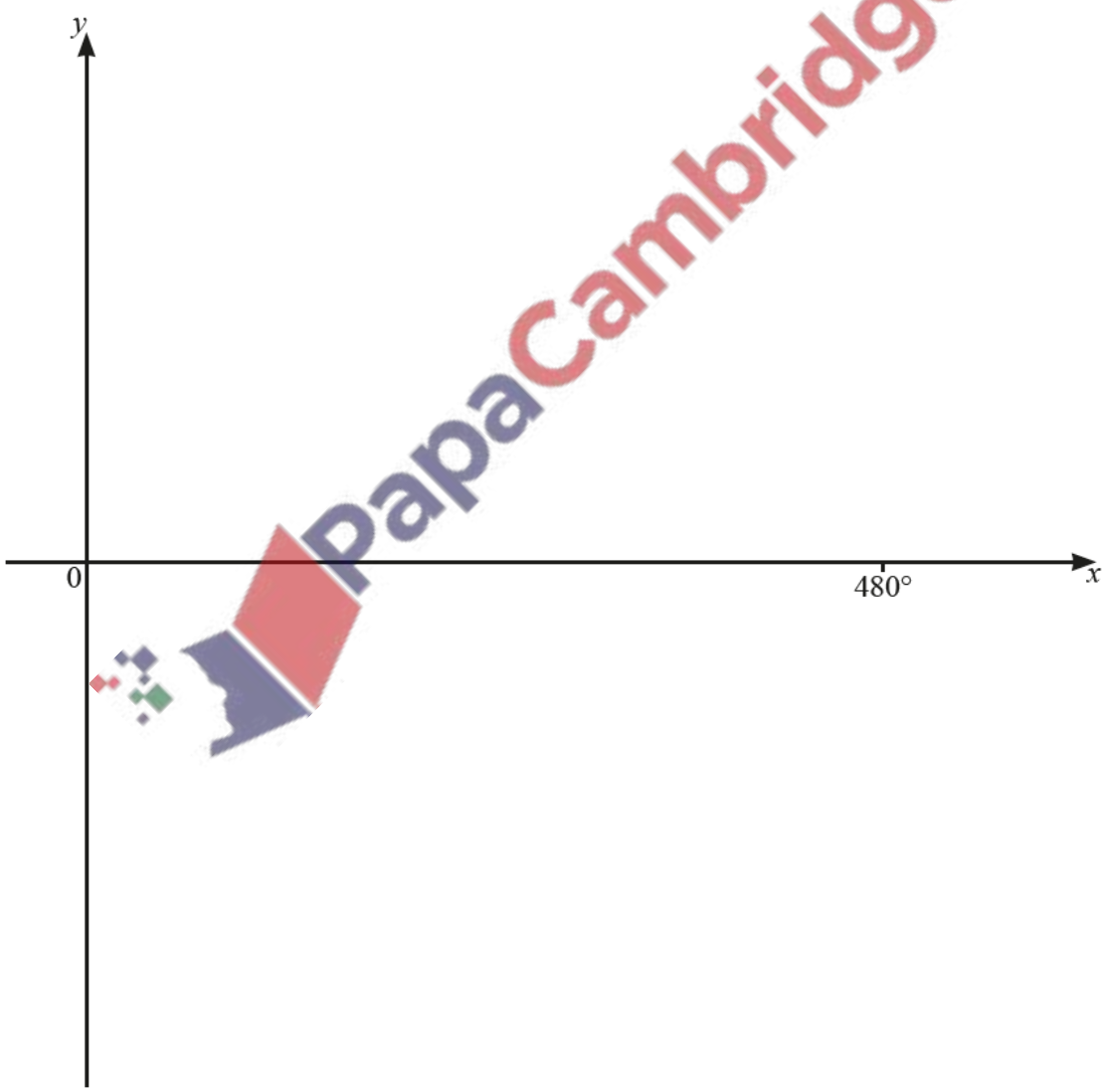
(b) Solve the equation $2x-11\sqrt{x}+12=0$. [3]

11. June/2021/Paper_21/No.4

The graph of $y = a + 2\tan bx$, where a and b are constants, passes through the point $(0, -4)$ and has period 480°.

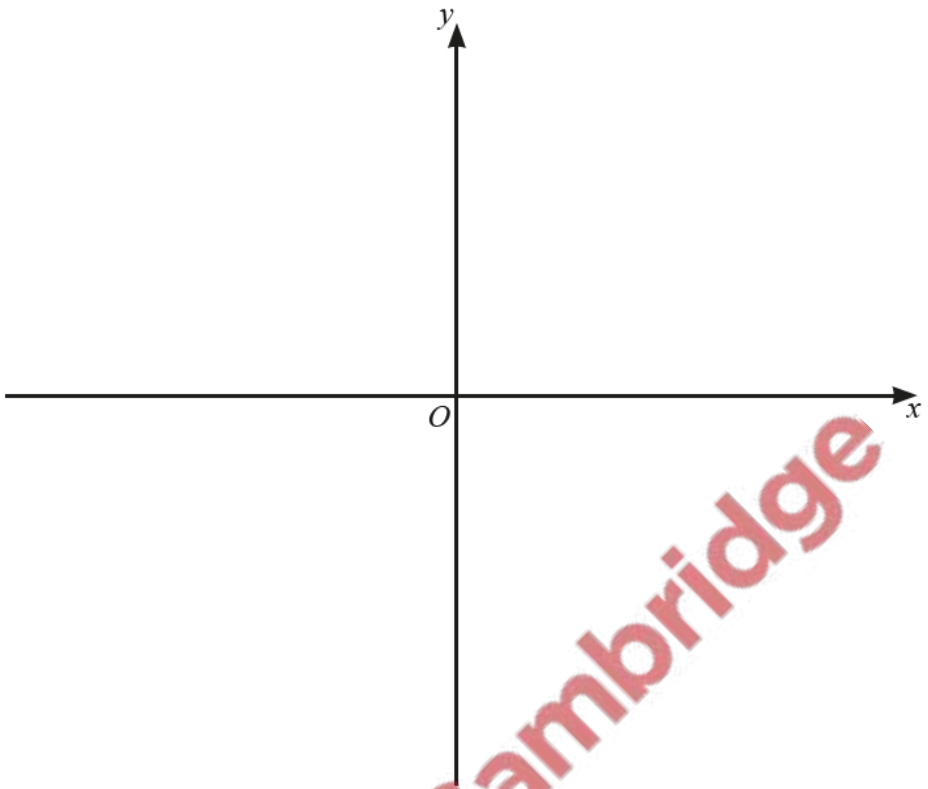
(a) Find the value of a and of b. [3]

(b) On the axes, sketch the graph of y for values of x between 0° and 480°. [2]



12. June/2021/Paper_22/No.2

On the axes, sketch the graph of $y = 3(x-3)(x-1)(x+2)$ stating the intercepts with the coordinate axes. [3]



13. June/2021/Paper_22/No.6

The points $A(5, -4)$ and $C(11, 6)$ are such that AC is the diagonal of a square, $ABCD$.

(a) Find the length of the line AC. [2]

(b) **(i)** The coordinates of the centre, E, of the square are $(8, y)$. Find the value of y. [1]

(ii) Find the equation of the diagonal BD. [3]

(iii) Given that the x-coordinate of B is less than the x-coordinate of D, write $\overrightarrow{EB}$ and $\overrightarrow{ED}$ as column vectors. [2]