

Here are some questions – feel free to give them a go – don't worry if you can't do some of them

1. The points A and B have coordinates $(2, 1)$ and $(5, -3)$ respectively.
 - (i) Find the length of AB . [2]
 - (ii) Find an equation of the line through the mid-point of AB which is perpendicular to AB , giving your answer in the form $ax + by + c = 0$ where a, b and c are integers. [7]

2.
 - (i) Find the set of values of k for which the line $y = 2x + k$ intersects the curve $y = 3x^2 + 12x + 13$. [5]
 - (ii) Express $y = 3x^2 + 12x + 13$ in the form $a(x + b)^2 + c$.
Hence show that the curve $y = 3x^2 + 12x + 13$ lies completely above the x -axis. [5]
 - (iii) Find the value of k for which the line $y = 2x + k$ passes through the minimum point of the curve $y = 3x^2 + 12x + 13$. [2]

3. Explain why each of the following statements is false. State in each case which of the symbols \Rightarrow, \Leftarrow or \Leftrightarrow would make the statement true.

- (i) $ABCD$ is a square \Leftrightarrow the diagonals of quadrilateral $ABCD$ intersect at 90° . [2]
- (ii) x^2 is an integer $\Rightarrow x$ is an integer. [2]

4. Given that $y = 2^x$,

- (a) express 4^x in terms of y . [1]
- (b) Hence, or otherwise, solve

$$8(4^x) - 9(2^x) + 1 = 0$$

[4]

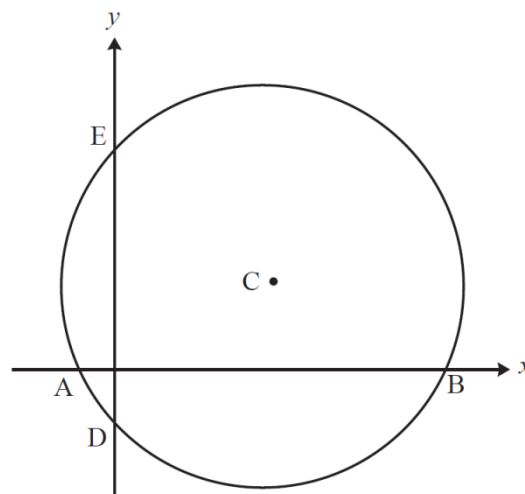
5. The figure opposite shows a sketch of the circle with equation

$$(x - 10)^2 + (y - 2)^2 = 125$$

and centre C .

The points A, B, D and E are the intersections of the circle with the axes.

- (i) Write down the radius of the circle and the coordinates of C . [2]



- (ii) Verify that B is the point $(21, 0)$ and find the coordinates of A, D and E . [4]

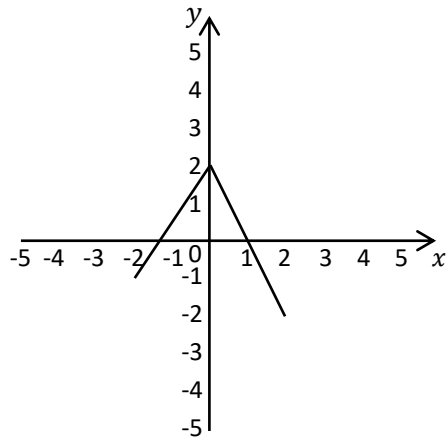
- (iii) Find the equation of the perpendicular bisector of BE and verify that this line passes through C . [6]

[6]

6. The line AB has equation $3x - 4y + 5 = 0$.
- (a) The point with coordinates $(p, p + 2)$ lies on the line AB . Find the value of the constant p . [2]
- (b) Find the gradient of AB . [2]
- (c) The point A has coordinates $(1, 2)$, The point $C(-5, k)$ is such that AC is perpendicular to AB . Find the value of k . [3]
7. (a) Express $4x^2 - 24x - 189$ in the form $a(x + b)^2 + c$, where the values of the constants a , b and c are to be found. [3]
- (b) Solve the equation $4x^2 - 24x - 189 = 0$. [3]
8. (a) Find the range of values of k for which the quadratic equation
- $$kx^2 + (2k - 5)x + (k - 6) = 0$$
- has no real roots. [4]
- (b) Write down the value of k for which the equation
- $$kx^2 + (2k - 5)x + (k - 6) = 0$$
- has two equal roots. [1]
9. You are given that n , $n + 1$ and $n + 2$ are three consecutive integers.
- (i) Expand and simplify
- $$n^2 + (n + 1)^2 + (n + 2)^2$$
- (ii) For what values of n will the sum of the squares of these three consecutive integers be an even number? Give a reason for your answer. [2]
10. A circle with centre C has equation $x^2 + y^2 + 2x - 6y - 40 = 0$.
- (a) Express the equation in the form
- $$(x - a)^2 + (y - b)^2 = d$$
- (b) (i) State the coordinates of C . [1]
- (ii) Find the radius of the circle, giving your answer in the form $n\sqrt{2}$. [2]
- (c) The point P with coordinates $(4, k)$ lies on the circle. Find the possible values of k . [3]
- (d) The points Q and R also lie on the circle, and the length of the chord QR is 2. Calculate the shortest distance from C to the chord QR .

11. The line AB has equation $3x + 5y = 7$.
- (a) Find the gradient of AB . [2]
 - (b) Find an equation of the line that is perpendicular to the line AB and which passes through the point $(-2, -3)$. Express your answer in the form $px + qy + r = 0$, where p, q and r are integers. [3]
 - (c) The line AC has equation $2x - 3y = 30$. Find the coordinates of A . [3]
12. (i) Sketch the curve $y = 2x^2 - x - 3$, giving the coordinates of all points of intersection with the axes.
- (ii) Hence, or otherwise, solve the inequality $2x^2 - x - 3 > 0$. [2]
- (iii) Given that the equation $2x^2 - x - 3 = k$ has no real roots, find the set of possible values of the constant k . [3]
13. (a) Simplify $(n + 3)^2 - n^2$. Hence explain why, when n is an integer, $(n + 3)^2 - n^2$ is never an even number. [3]
- (b) Given also that $(n + 3)^2 - n^2$ is divisible by 9, what can you say about n ? [1]
14. A circle with centre C has equation $x^2 + y^2 - 10x + 4y + 4 = 0$.
- (a) Find the coordinates of C and the radius of the circle. [3]
 - (b) Show that the tangent to the circle at the point $P(8, 2)$ has equation $3x + 4y = 32$ [5]
 - (c) The circle meets the y -axis at Q and the tangent meets the y -axis at R . Find the area of triangle PQR .

4.



The figure above shows the graph of $y = f(x)$. Draw the graphs of the following.

(i) $y = f(x) - 2$

[2]

(ii) $y = f(x - 3)$

[2]

