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Question 2 continued

Lined area for writing the answer to Question 2.

(Total 7 marks)

Q2



Question 3 continued

Lined area for writing the answer to Question 3.

Q3

(Total 5 marks)



4. Solve the simultaneous equations

$$\begin{aligned}x + y &= 2 \\4y^2 - x^2 &= 11\end{aligned}\tag{7}$$



5. A sequence a_1, a_2, a_3, \dots is defined by

$$\begin{aligned} a_1 &= k, \\ a_{n+1} &= 5a_n + 3, \quad n \geq 1, \end{aligned}$$

where k is a positive integer.

(a) Write down an expression for a_2 in terms of k . (1)

(b) Show that $a_3 = 25k + 18$. (2)

(c) (i) Find $\sum_{r=1}^4 a_r$ in terms of k , in its simplest form.

(ii) Show that $\sum_{r=1}^4 a_r$ is divisible by 6. (4)



6. Given that $\frac{6x + 3x^{\frac{5}{2}}}{\sqrt{x}}$ can be written in the form $6x^p + 3x^q$,

(a) write down the value of p and the value of q .

(2)

Given that $\frac{dy}{dx} = \frac{6x + 3x^{\frac{5}{2}}}{\sqrt{x}}$, and that $y = 90$ when $x = 4$,

(b) find y in terms of x , simplifying the coefficient of each term.

(5)



7. $f(x) = x^2 + (k+3)x + k$

where k is a real constant.

- (a) Find the discriminant of $f(x)$ in terms of k . **(2)**

- (b) Show that the discriminant of $f(x)$ can be expressed in the form $(k+a)^2 + b$, where a and b are integers to be found. **(2)**

- (c) Show that, for all values of k , the equation $f(x) = 0$ has real roots. **(2)**



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Question 7 continued

Lined area for writing answers to Question 7.

(Total 6 marks)

Q7



8.

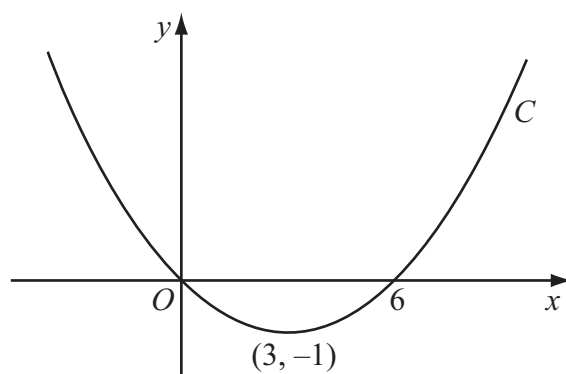
**Figure 1**

Figure 1 shows a sketch of the curve C with equation $y = f(x)$.
The curve C passes through the origin and through $(6, 0)$.
The curve C has a minimum at the point $(3, -1)$.

On separate diagrams, sketch the curve with equation

(a) $y = f(2x)$, **(3)**

(b) $y = -f(x)$, **(3)**

(c) $y = f(x + p)$, where p is a constant and $0 < p < 3$. **(4)**

On each diagram show the coordinates of any points where the curve intersects the x -axis and of any minimum or maximum points.



Question 8 continued



Question 8 continued



Question 8 continued

Q8

(Total 10 marks)



9. (a) Calculate the sum of all the even numbers from 2 to 100 inclusive,

$$2 + 4 + 6 + \dots + 100$$

(3)

(b) In the arithmetic series

$$k + 2k + 3k + \dots + 100$$

k is a positive integer and k is a factor of 100.

(i) Find, in terms of k , an expression for the number of terms in this series.

(ii) Show that the sum of this series is

$$50 + \frac{5000}{k}$$

(4)

(c) Find, in terms of k , the 50th term of the arithmetic sequence

$$(2k + 1), (4k + 4), (6k + 7), \dots ,$$

giving your answer in its simplest form.

(2)



Question 9 continued

Lined writing area for the answer to Question 9.

(Total 9 marks)

Q9



10. The curve C has equation

$$y = (x+1)(x+3)^2$$

(a) Sketch C , showing the coordinates of the points at which C meets the axes. (4)

(b) Show that $\frac{dy}{dx} = 3x^2 + 14x + 15$. (3)

The point A , with x -coordinate -5 , lies on C .

(c) Find the equation of the tangent to C at A , giving your answer in the form $y = mx + c$, where m and c are constants. (4)

Another point B also lies on C . The tangents to C at A and B are parallel.

(d) Find the x -coordinate of B . (3)



Question 10 continued

Lined writing area for the response to Question 10. The area contains 24 horizontal lines.



