10:

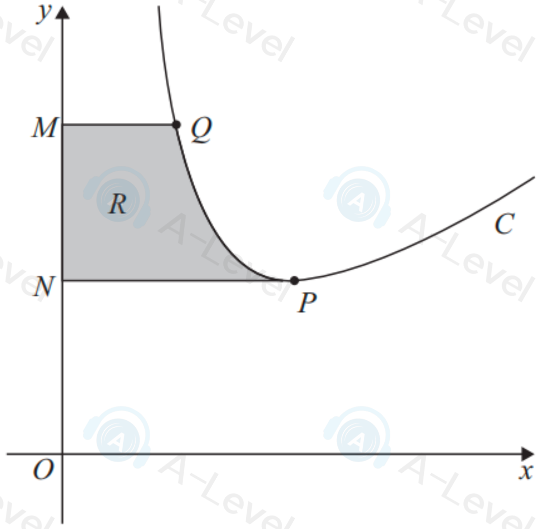

Figure 3

In this question you must show all stages of your working.
Solutions relying entirely on calculator technology are not acceptable.

Figure 3 shows a sketch of the curve C with equation

$$y = 2x + \frac{64}{x^2} - 3 \qquad x > 0$$

The point P, shown in Figure 3, is the stationary point on C.

(a) Show, using calculus, that the x coordinate of P is 4

(4)

The point Q lies on C and has x coordinate 2

The line segments MQ and NP, shown in Figure 3, are parallel to the x-axis.

The region R, shown shaded in Figure 3, is bounded by C, the y-axis and line segments MQ and NP.

(b) Use algebraic integration to find the exact area of R.

You must make your method clear.

(5)

7. **In this question you must show all stages of your working.**
Solutions relying entirely on calculator technology are not acceptable.

(i) Solve, for $0 \leqslant \theta < 180°$, the equation

$$7\sin 2\theta = 5\cos 2\theta$$

giving your answers, in degrees, to one decimal place.

(4)

(ii) Solve, for $0 \leqslant x < 2\pi$, the equation

$$24\tan x = 5\cos x$$

giving your answers, in radians, to 3 decimal places.

(5)

(Total for Question 7 is 9 marks)

5.

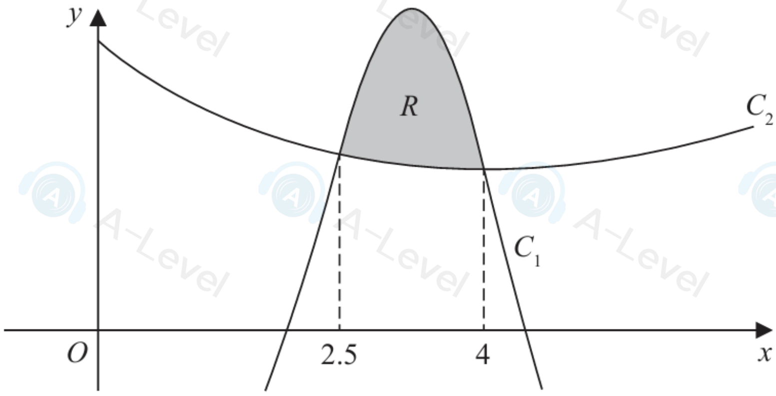

Figure 2

Figure 2 shows a sketch of part of the graph of the curves C_1 and C_2

The curves intersect when $x = 2.5$ and when $x = 4$

A table of values for some points on the curve C_1 is shown below, with y values given to 3 decimal places as appropriate.

x	2.5	2.75	3	3.25	3.5	3.75	4
y	5.453	7.764	9.375	9.964	9.367	7.626	5

Using the trapezium rule with all the values of y in the table,

(a) find, to 2 decimal places, an estimate for the area bounded by the curve C_1, the line with equation $x = 2.5$, the x-axis and the line with equation $x = 4$

(4)

The curve C_2 has equation

$$y = x^{\frac{3}{2}} - 3x + 9 \qquad x > 0$$

(b) Find $\int \left(x^{\frac{3}{2}} - 3x + 9 \right) \mathrm{d}x$

(3)

The region R, shown shaded in Figure 2, is bounded by the curves C_1 and C_2

(c) Use the answers to part (a) and part (b) to find, to one decimal place, an estimate for the area of the region R.

(3)

1 The variables x and y satisfy the equation $a^{2y} = e^{3x+k}$, where a and k are constants. The graph of y against x is a straight line.

(a) Use logarithms to show that the gradient of the straight line is $\dfrac{3}{2\ln a}$. [1]

(b) Given that the straight line passes through the points $(0.4, 0.95)$ and $(3.3, 3.80)$, find the values of a and k. [4]

2 Use logarithms to solve the equation $6^{2x-1} = 5e^{3x+2}$. Give your answer correct to 4 significant figures. [4]

8. **In this question you must show all stages of your working.**

Solutions relying entirely on calculator technology are not acceptable.

(i) Solve, for $0 < \theta < 360°$, the equation

$$3\sin(\theta + 30°) = 7\cos(\theta + 30°)$$

giving your answers to one decimal place. **(4)**

(ii) (a) Show that the equation

$$3\sin^3 x = 5\sin x - 7\sin x\cos x$$

can be written in the form

$$\sin x(a\cos^2 x + b\cos x + c) = 0$$

where a, b and c are constants to be found.

(b) Hence solve for $-\dfrac{\pi}{2} \leqslant x \leqslant \dfrac{\pi}{2}$ the equation

$$3\sin^3 x = 5\sin x - 7\sin x\cos x$$

(6)

blank

9. (a) Show that the equation

$$\cos\theta - 1 = 4\sin\theta\tan\theta$$

can be written in the form

$$5\cos^2\theta - \cos\theta - 4 = 0$$

(4)

(b) Hence solve, for $0 \leqslant x < \frac{\pi}{2}$

$$\cos 2x - 1 = 4\sin 2x\tan 2x$$

giving your answers, where appropriate, to 2 decimal places.

(4)

DO NOT WRITE IN THIS AREA

2 Solve the inequality $|x-7| > 4x+3$. [4]

10. The circle C has centre $X(3, 5)$ and radius r

The line l has equation $y = 2x + k$, where k is a constant.

(a) Show that l and C intersect when

$$5x^2 + (4k - 26)x + k^2 - 10k + 34 - r^2 = 0$$

(3)

Given that l is a tangent to C,

(b) show that $5r^2 = (k + p)^2$, where p is a constant to be found.

(3)

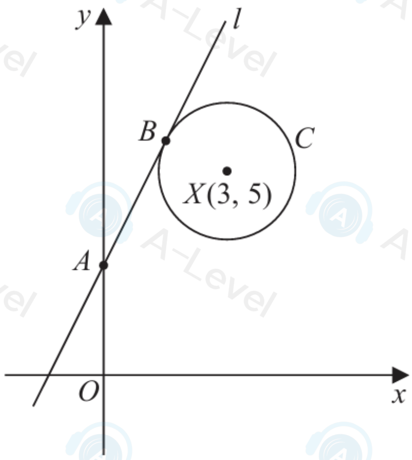

Figure 2

The line l

- cuts the y-axis at the point A
- touches the circle C at the point B

as shown in Figure 2.

Given that $AB = 2r$

(c) find the value of k

(6)