Leave blank

2. In the triangle ABC,

- $AB = 21$ cm
- $BC = 13$ cm
- angle $BAC = 25°$
- angle $ACB = x°$

(a) Use the sine rule to find the value of $\sin x°$, giving your answer to 4 decimal places. **(2)**

Given also that AB is the longest side of the triangle,

(b) find the value of x, giving your answer to 2 decimal places. **(3)**

DO NOT WRITE IN THIS AREA

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

Solutions relying on calculator technology are not acceptable.

(a) Solve

$$5(x+3) > 4(2x-5)$$

(2)

(b) (i) Write

$$x^2 - 6x + 1$$

in the form $(x+a)^2 + b$ where a and b are constants.

(ii) Hence solve

$$x^2 - 6x + 1 \geqslant 0$$

(4)

(c) Hence find the values of x that satisfy both

$$5(x+3) > 4(2x-5) \quad \textbf{and} \quad x^2 - 6x + 1 \geqslant 0$$

(1)

DO NOT WRITE IN THIS AREA

DO NOT WR

blank

2. Given $y = 3^x$, express each of the following in terms of y. Write each expression in its simplest form.

(a) 3^{3x} **(1)**

(b) $\dfrac{1}{3^{x-2}}$ **(2)**

(c) $\dfrac{81}{9^{2-3x}}$ **(2)**

DO NOT WRITE IN THIS

1. Find

$$\int (2x - 5)(3x + 2)(2x + 5)\,dx$$

writing your answer in simplest form.

(5)

DO NOT WRIT

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

(i) Using the laws of indices, solve

$$2^{4k-3} = \frac{8^{1-k}}{4\sqrt{2}}$$

(3)

(ii) Solve the equation

$$\frac{x\sqrt{3} + 2}{\sqrt{3} - 1} = x\sqrt{3} - 4$$

giving the answer in the form $a + b\sqrt{3}$, where a and b are rational numbers.

(4)

DO NOT WRITE IN THIS AREA

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4. Find

$$\int \frac{(3\sqrt{x} + 2)(x - 5)}{4\sqrt{x}}\,dx$$

writing each term in simplest form.

(6)

DO NOT WRITE I

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

A curve has equation $y = \mathrm{f}(x),\ x > 0$

The point $P(4, 12)$ lies on the curve.

Given that

- $\mathrm{f}'(x) = 3\sqrt{x} + kx^2$ where k is a constant
- the equation of the tangent to the curve at P has equation $y = 10x + c$ where c is a constant

(a) (i) show that $k = \frac{1}{4}$

(ii) find the value of c

(4)

(b) Hence find the value of $\mathrm{f}''(x)$ at P.

(3)

(c) Find $\mathrm{f}(x)$.

(4)

blank

5. A curve has equation

$$y = \frac{x^3}{6} + 4\sqrt{x} - 15 \qquad x \geqslant 0$$

(a) Find $\frac{\mathrm{d}y}{\mathrm{d}x}$, giving the answer in simplest form.

(3)

The point $P\left(4, \frac{11}{3}\right)$ lies on the curve.

(b) Find the equation of the normal to the curve at P. Write your answer in the form $ax + by + c = 0$, where a, b and c are integers to be found.

(4)

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

Solutions relying on calculator technology are not acceptable.

Solve the inequality

$$4x^2 - 3x + 7 \geqslant 4x + 9$$

(4)

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

$$(k-1)x^6 + 4x^3 + (k-4) = 0 \qquad \text{where } k \text{ is a constant}$$

(a) Find the exact solutions to the given equation for $k = 4.5$

(3)

(b) Find the set of possible values of k for which the given equation has no real roots.

(4)

blank

4.

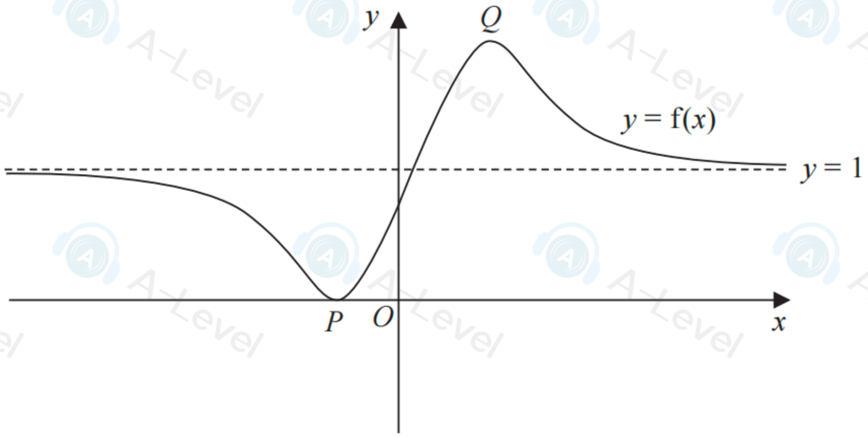

Figure 1

Figure 1 shows a sketch of a curve with equation $y = \mathrm{f}(x)$

The curve has a minimum at $P(-1, 0)$ and a maximum at $Q\left(\frac{3}{2}, 2\right)$

The line with equation $y = 1$ is the only asymptote to the curve.

On separate diagrams sketch the curves with equation

(i) $y = \mathrm{f}(x) - 2$

(3)

(ii) $y = \mathrm{f}(-x)$

(3)

On each sketch you must clearly state

- the coordinates of the maximum and minimum points
- the equation of the asymptote

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

The curve C has equation $y = f(x)$, $x > 0$

Given that

- $f'(x) = \dfrac{12}{\sqrt{x}} + \dfrac{x}{3} - 4$
- the point $P(9, 8)$ lies on C

(a) find, in simplest form, $f(x)$

(5)

The line l is the normal to C at P

(b) Find the coordinates of the point at which l crosses the y-axis.

(4)

7.

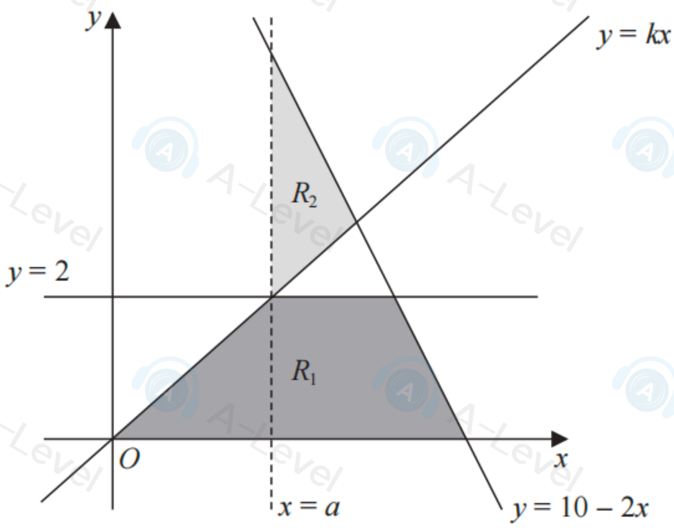

Figure 2

The region R_1, shown shaded in Figure 2, is defined by the inequalities

$$0 \leqslant y \leqslant 2 \qquad y \leqslant 10 - 2x \qquad y \leqslant kx$$

where k is a constant.

The line $x = a$, where a is a constant, passes through the intersection of the lines $y = 2$ and $y = kx$

Given that the area of R_1 is $\dfrac{27}{4}$ square units,

(a) find

(i) the value of a

(ii) the value of k

(4)

(b) Define the region R_2, also shown shaded in Figure 2, using inequalities.

(2)