4.

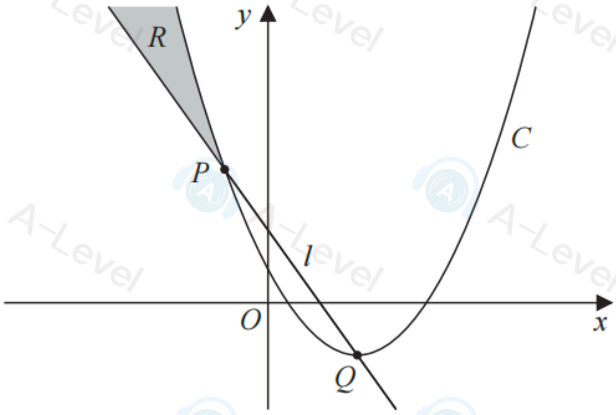

Figure 2

The points P and Q, as shown in Figure 2, have coordinates $(-2, 13)$ and $(4, -5)$ respectively.

The straight line l passes through P and Q.

(a) Find an equation for l, writing your answer in the form $y = mx + c$, where m and c are integers to be found.

(3)

The quadratic curve C passes through P and has a minimum point at Q.

(b) Find an equation for C.

(3)

The region R, shown shaded in Figure 2, lies in the second quadrant and is bounded by C and l only.

(c) Use inequalities to define region R.

(2)

Leave blank

8. The straight line l has equation $y = k(2x - 1)$, where k is a constant.

The curve C has equation $y = x^2 + 2x + 11$

Find the set of values of k for which l does not cross or touch C.

(6)

9. (i)

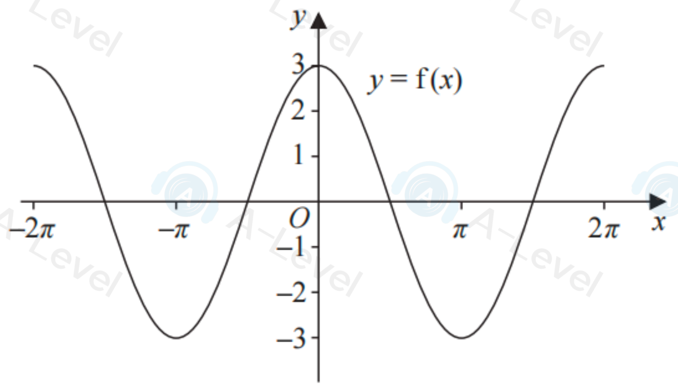

Figure 3

Figure 3 shows part of the graph of the trigonometric function with equation $y = \mathrm{f}(x)$

(a) Write down an expression for $\mathrm{f}(x)$

(2)

On a separate diagram,

(b) sketch, for $-2\pi < x < 2\pi$, the graph of the curve with equation $y = \mathrm{f}\left(x + \frac{\pi}{4}\right)$

Show clearly the coordinates of all the points where the curve intersects the coordinate axes.

(3)

(ii)

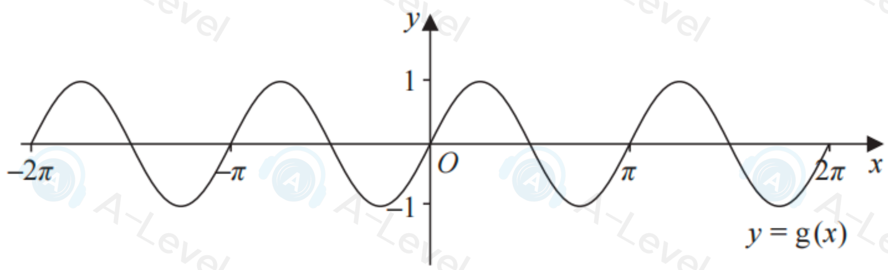

Figure 4

Figure 4 shows part of the graph of the trigonometric function with equation $y = \mathrm{g}(x)$

(a) Write down an expression for $\mathrm{g}(x)$

(2)

On a separate diagram,

(b) sketch, for $-2\pi < x < 2\pi$, the graph of the curve with equation $y = \mathrm{g}(x) - 2$

Show clearly the coordinates of the y intercept.

(2)

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

Solutions relying on calculator technology are not acceptable.

(a) Sketch the curve C with equation

$$y = \frac{1}{2 - x} \qquad x \neq 2$$

State on your sketch

- the equation of the vertical asymptote
- the coordinates of the intersection of C with the y-axis

(3)

The straight line l has equation $y = kx - 4$, where k is a constant.

Given that l cuts C at least once,

(b) (i) show that

$$k^2 - 5k + 4 \geqslant 0$$

(ii) find the range of possible values for k.

(6)

blank

10. A curve has equation $y = f(x)$, where

$$f(x) = (x - 4)(2x + 1)^2$$

The curve touches the x-axis at the point P and crosses the x-axis at the point Q.

(a) State the coordinates of the point P.

(1)

(b) Find $f'(x)$.

(4)

(c) Hence show that the equation of the tangent to the curve at the point where $x = \frac{5}{2}$ can be expressed in the form $y = k$, where k is a constant to be found.

(3)

The curve with equation $y = f(x + a)$, where a is a constant, passes through the origin O.

(d) State the possible values of a.

(2)

7.

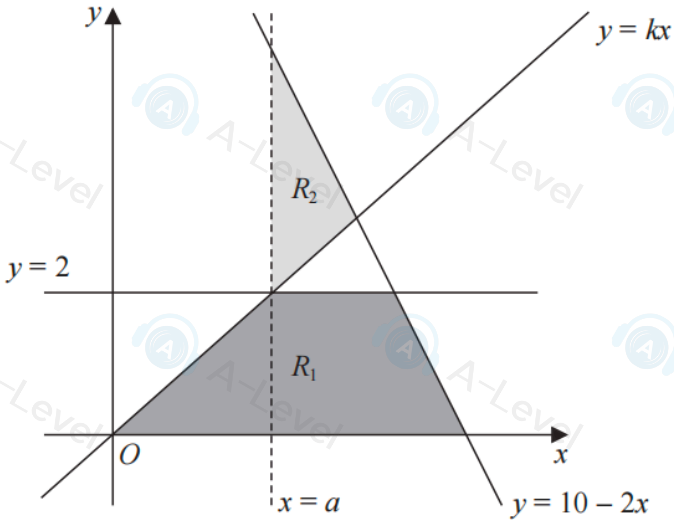

Figure 2

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 $\frac{27}{4}$ 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)

1. The curve C has equation

$$y = \frac{x^2}{3} + \frac{4}{\sqrt{x}} + \frac{8}{3x} - 5 \qquad x > 0$$

(a) Find $\frac{dy}{dx}$, giving your answer in simplest form.

(4)

The point $P(4, 3)$ lies on C.

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

(4)

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 $k = \dfrac{1}{4}$

(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)

4. Given that the equation

$$kx^2 + 6kx + 5 = 0 \qquad \text{where } k \text{ is a non zero constant}$$

has no real roots, find the range of possible values for k.

(4)