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

$$f'(x) = 3\sqrt{x} - \frac{9}{x\sqrt{x}} + \frac{4}{3}$$

Given that the point $P(9, 20)$ lies on C,

(a) find $f(x)$, simplifying the answer,

(5)

(b) find an equation of the normal to C at the point P, giving the answer in the form $ax + by + c = 0$ where a, b and c are integers.

(4)

(Total for Question 7 is 9 marks)

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

Find the range of values of k for which the quadratic equation

$$kx^2 + 8x + 2(k + 7) = 0$$

has no real roots.

(6)

(Total for Question 8 is 6 marks)

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9. Given that k is a constant, $0 < k < 1$, state the number of solutions of the equation

(a) $\sin x = k$ in the interval $0 < x \leqslant \pi$

(b) $\tan x = k$ in the interval $0 < x \leqslant \pi$

(c) $\cos 2x = k$ in the interval $0 < x \leqslant 100\pi$

(d) $\sin x = k + 1$ in the interval $-100\pi < x \leqslant 100\pi$

(4)

(Total for Question 9 is 4 marks)

10.

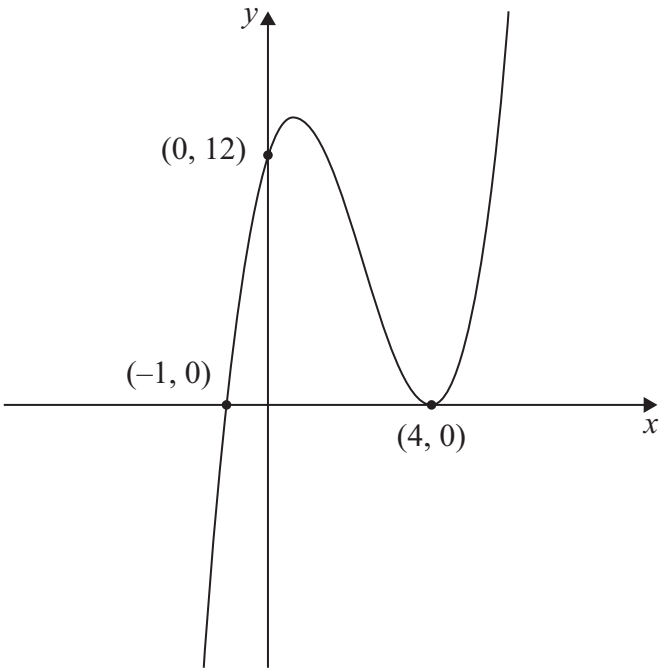

Figure 4

Figure 4 shows a sketch of the curve C_1 with equation $y = f(x)$ where $f(x)$ is a cubic function in x.

The curve

- cuts the x and y axes at $(-1, 0)$ and $(0, 12)$ respectively
- has a minimum turning point at $(4, 0)$

as shown in Figure 4.

(a) Find $f(x)$

(4)

The curve C_2 has equation $y = g(x)$ where $g(x) = 6(x + 1)(x - 2)$

(b) Find the exact x coordinates of the points of intersection of curves C_1 and C_2

(*Solutions relying on calculator technology are not acceptable.*)

(4)

(Total for Question 10 is 8 marks)

TOTAL FOR PAPER IS 75 MARKS