**8.**

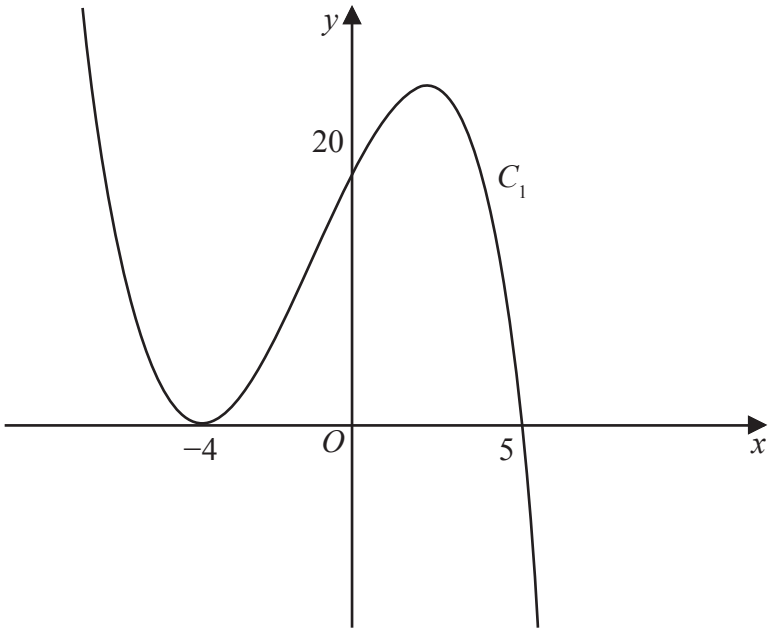



**Figure 4**

**In this question you must show detailed reasoning.**
**Solutions relying on calculator technology are not acceptable.**

Figure 4 shows the curve $C_1$ with equation $y = \mathrm{f}(x)$ where $\mathrm{f}(x)$ is a cubic function in $x$.

The curve $C_1$

- cuts the $x$-axis at 5 and the $y$-axis at 20
- touches the $x$-axis at $-4$

as shown in Figure 4.

(a) Deduce the range of values of $x$ for which $\mathrm{f}(x) \leqslant 0$

**(2)**

(b) Find an expression for $\mathrm{f}(x)$ in terms of $x$.
Give the answer in a fully factorised form.

**(3)**

The curve $C_2$ has equation $y = 3x(x - 5)$

(c) Find the exact $x$ coordinates of all points of intersection of $C_1$ and $C_2$

**(4)**

**(Total for Question 8 is 9 marks)**

**9.**

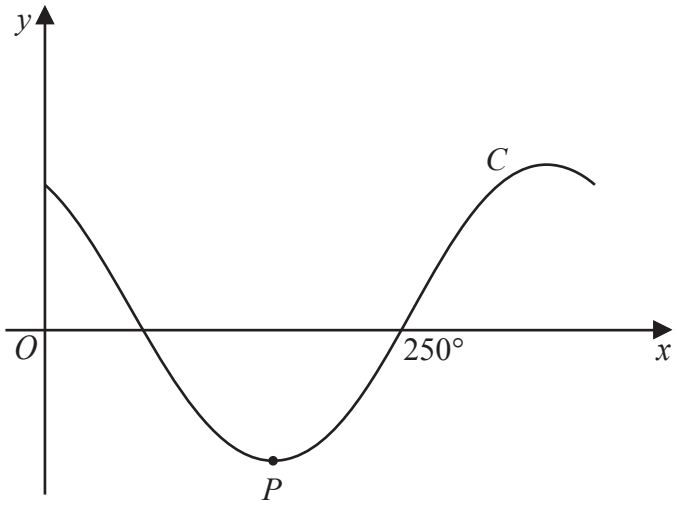



**Figure 5**

Figure 5 shows a sketch of the curve $C$ with equation

$$y = \cos(x + k°) \qquad 0 \leqslant x < 360°$$

where $x$ is measured in degrees and $k$ is a constant.

The curve $C$

- cuts the $x$-axis at $250°$
- has a minimum point at $P$

as shown in Figure 5.

(a) State the value of $k$.

**(1)**

(b) State the coordinates of $P$.

**(1)**

(c) Solve the equation

$$\cos(x + k°) = 0$$

for values of $x$ in the range $3600° \leqslant x < 3960°$

**(2)**

(d) Find the coordinates of the point to which $P$ is mapped when $C$ is transformed to the curve with equation

(i) $y = -4\cos(x + k°)$

(ii) $y = \cos(x - 3k°)$

**(2)**

**(Total for Question 9 is 6 marks)**