7. The curve C has equation $y = \mathrm{f}(x)$, $x > 0$

The point P with x coordinate 4 lies on C.

Given that

- $\mathrm{f}'(x) = \dfrac{k - \sqrt{x}}{2x^2}$ where k is a constant
- the normal to C at P has equation $y + 2x - 5 = 0$

(a) (i) show that $k = 18$

(ii) find the equation of the tangent to C at P. Give the answer in the form $y = mx + c$, where m and c are constants.

(6)

(b) Find an expression for $\mathrm{f}(x)$ in terms of x, giving the answer in simplest form.

(5)

(Total for Question 7 is 11 marks)

8.

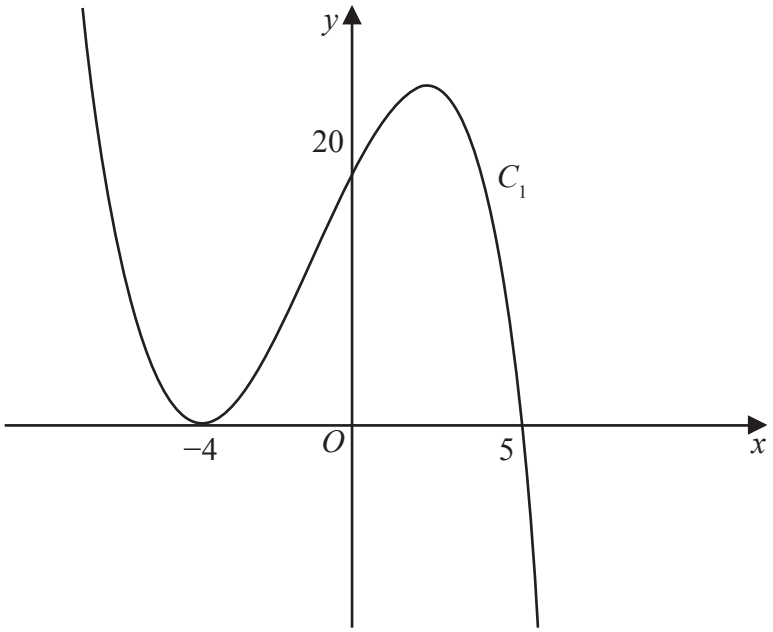

Figure 4

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)