1. Find

$$\int \frac{3x^4 - 4}{2x^3} \, \mathrm{d}x$$

writing your answer in simplest form.

(4)

2. Find

$$\int \left(8x^3 - \frac{3}{2\sqrt{x}} + 5\right) dx$$

giving your answer in simplest form.

(4)

3. The height, h metres, of a plant, t years after it was first measured, is modelled by the equation

$$h = 2.3 - 1.7e^{-0.2t} \qquad t \in \mathbb{R} \quad t \geqslant 0$$

Using the model,

(a) find the height of the plant when it was first measured,

(2)

(b) show that, exactly 4 years after it was first measured, the plant was growing at approximately 15.3 cm per year.

(3)

According to the model, there is a limit to the height to which this plant can grow.

(c) Deduce the value of this limit.

(1)

4. A curve has equation $y = f(x), \; x \geqslant 0$

Given that

- $f'(x) = 4x + a\sqrt{x} + b$, where a and b are constants

- the curve has a stationary point at $(4, 3)$

- the curve meets the y-axis at -5

find $f(x)$, giving your answer in simplest form.

(6)

5. Find

$$\int \frac{x^{\frac{1}{2}}(2x-5)}{3} \, \mathrm{d}x$$

writing each term in simplest form.

(4)

6. The curve C has equation $y = f(x)$

The curve

- passes through the point $P(3, -10)$

- has a turning point at P

Given that

$$\frac{dy}{dx} = 2x^3 - 9x^2 + 5x + k$$

where k is a constant,

(a) show that $k = 12$

(2)

(b) Hence find the coordinates of the point where C crosses the y-axis.

(3)