3

1 Differentiate each of the following with respect to *x*.

(a)
$$y = \tan^3(2-4x)$$
 [1]

$$\mathbf{(b)} \qquad y = \ln\left(\frac{3x^2}{2x-1}\right) \tag{2}$$

[Turn over



3 Given that a curve has the equation $y = (2x+3)e^{2x}$, find the equation of the normal to the curve at the point where the curve cuts the *y*-axis. [4]

4 Water is poured into a bucket at a rate of 25π cm³/s. The volume, V cm³, of water in the bucket when the depth of water is x cm is given by $V = \frac{\pi x^2 (15 - x)}{3}$. Find the rate of increase in the depth of water when x = 5. [4]

5 (a) Find
$$\frac{d}{dx} (2\cos^2 x - \sin 2x)$$
. [1]

Question removed as it is not part of 2024 WA 2 scope

6 A piece of wire, p cm long, is bent to form the shape as shown in the diagram. ACDE is a rectangle with AE = y cm and $\triangle ABC$ is a right-angled triangle with AB = 13x cm and BC = 5x cm.



(a) Express p in terms of x and y.

[2]

(b) Given that the area enclosed by the shape is 96 cm², show that $p = 25x + \frac{16}{x}$. [3] (c) Hence, find the value of x for which p has a minimum value. [4]

End of Paper

Answers:

1a.
$$-12\tan^{2}(2-4x)\sec^{2}(2-4x)$$

1b. $\frac{2}{x} - \frac{2}{2x-1}$
2a. $\frac{(3x+4)^{6}}{18} + c$
2b. $\frac{1}{2}\sin(2x-5) + c$
2c. $e^{x-1} - 2e^{-x} + c$
2d. $\frac{x^{2}}{2} + 2x - 3\ln x - \frac{1}{x} + c$
3. $y = -\frac{1}{8}x + 3$
4. 1 cm/s
5a. $-4\sin x - 2\cos 2x$
5b. $-\frac{1}{2}\cos^{2} x + c$
6a. $p = 30x + 2y$
6c. $\frac{4}{5}$