

Show all work clearly and in order. Please box your answers. 10 minutes.

- 8 1. Differentiate the following functions using any (correct) method.

(a) $y = \sqrt{\sin(x)} = (\sin(x))^{1/2}$

$$y' = \frac{1}{2} (\sin(x))^{-1/2} \frac{d}{dx} \sin(x)$$

$$\boxed{y' = \frac{1}{2} (\sin(x))^{-1/2} \cos(x)}$$

(b) $g(x) = \tan(3x)$

$$g'(x) = \sec^2(3x) \frac{d}{dx} 3x$$

$$g'(x) = \sec^2(3x) 3$$

so

$$\boxed{g'(x) = 3 \sec^2(3x)}$$

(c) $f(t) = \sqrt{1+t^2} = (1+t^2)^{1/2}$

$$f'(t) = \frac{1}{2} (1+t^2)^{-1/2} \frac{d}{dt} (1+t^2)$$

$$f'(t) = \frac{1}{2} (1+t^2)^{-1/2} (2t)$$

so

$$\boxed{f'(t) = t (1+t^2)^{-1/2}}$$

(d) $u = \cos^5(x) = [\cos(x)]^5$

$$u' = 5 (\cos(x))^4 (-\sin(x))$$

$$\boxed{u' = -5 \cos^4(x) \sin(x)}$$

- 2 2. If $f(x) = \sin\left(g(x) + \frac{\pi}{2}\right)$, where $g(3) = 0$ and $g'(3) = 5$, find $f'(3)$.

$$f'(x) = \cos\left(g(x) + \frac{\pi}{2}\right) \frac{d}{dx} \left(g(x) + \frac{\pi}{2}\right)$$

$$= \cos\left(g(x) + \frac{\pi}{2}\right) (g'(x) + 0)$$

$$= \cos\left(g(x) + \frac{\pi}{2}\right) g'(x)$$

so

$$f'(3) = \cos\left(g(3) + \frac{\pi}{2}\right) g'(3)$$

$$f'(3) = \cos\left(0 + \frac{\pi}{2}\right) 5 = \cos\left(\frac{\pi}{2}\right) 5$$

$$\boxed{f'(3) = 0}$$