

Example 1

Let

$$h(x) = \sqrt{x} + x$$

- (a) Use the definition of the derivative at a point

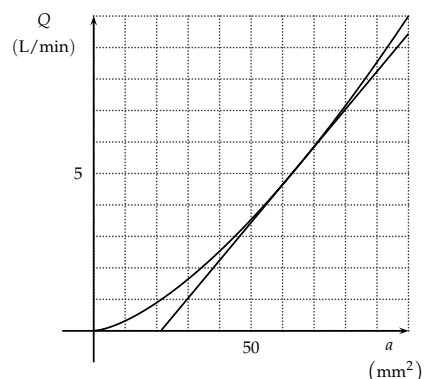
$$h'(a) = \lim_{x \rightarrow a} \frac{h(x) - h(a)}{x - a}$$

to find $h'(4)$.

- (b) Use your result in part (a) above to find the equation of the tangent to the curve
- $y = \sqrt{x} + x$
- at the point on the curve where
- $x = 4$
- .

Example 2

The function $Q = F(a)$ gives the flow rate, in litres per minute, out of a hole in the bottom of a jug as a function of the area a of the hole in square millimetres. The graph of the function F is shown for a from 0 to 100 mm^2 together with the line tangent to the graph at the point where $a = 64 \text{ mm}^2$.



- (a) Describe what the derivative $\frac{dQ}{da}$ represents and give its units. It is not sufficient to simply say that it is the slope of the graph at a certain point.
- (b) By estimating the slope of the tangent line estimate the value of $F'(64)$.
- (c) Explain in layman's terms what the value of the derivative in part (b) above tells you.

Example 3

Let

$$F(x) = \frac{3x}{1 + 2x}$$

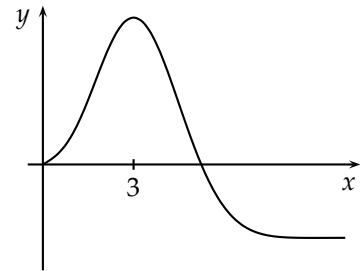
Use the definition of the derivative

$$F'(x) = \lim_{h \rightarrow 0} \frac{F(x+h) - F(x)}{h}$$

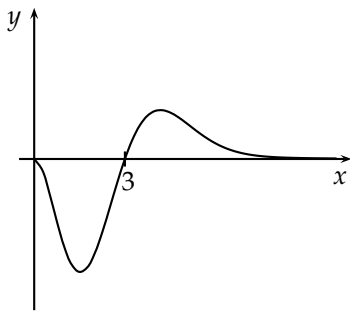
to find $F'(x)$.

Example 4

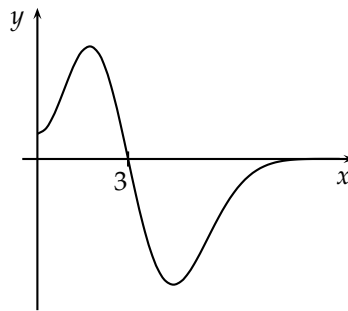
The graph of a function f is shown.



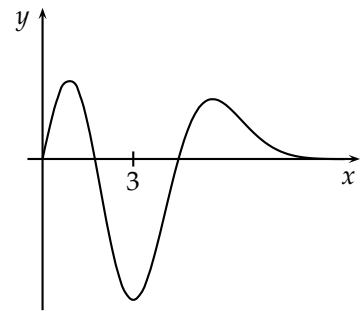
- (a) The graphs of three functions are shown below. Choose the one that is the graph of the derivative of the function f .



(A)



(B)



(C)

- (b) Choose the graph from the graphs in part (a) above that is the graph of the second derivative of the function f .
- (c) Explain your choices in parts (a) and (b).