

$$y = -5(x+2) + 2$$

$$y = -5x - 10 + 2$$

$$y = -5x - 8 \text{ - eqn}$$

Find the derivative

$$\textcircled{8} \quad f(x) = x^2 - 10x + 3$$

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

$$f(x) = x^2 - 10x + 3$$

$$f(x+h) = (x+h)^2 - 10(x+h) + 3$$

$$= x^2 + 2xh + h^2 - 10x - 10h + 3$$

$$\lim_{h \rightarrow 0} \frac{x^2 + 2xh + h^2 - 10x - 10h + 3 - (x^2 - 10x + 3)}{h}$$

$$= \lim_{h \rightarrow 0} \frac{h^2 + 2xh - 10h}{h}$$

$$= \lim_{h \rightarrow 0} \frac{h(h + 2x - 10)}{h}$$

$$\lim_{h \rightarrow 0} h + 2x - 10 = 2x - 10$$

$$f'(x) = 2x - 10$$

$\textcircled{9} \quad f(x) = x^2 - 7x + 12$

Point (2, 2)

Find the eqn of the tangent line

$$f(x) = x^2 - 7x + 12$$

$$f(x+h) = (x+h)^2 - 7(x+h) + 12$$

$$f'(x) = \lim_{h \rightarrow 0} \left[\frac{f(x+h) - f(x)}{h} \right]$$

$$= \lim_{h \rightarrow 0} \left[\frac{(x+h)^2 - 7(x+h) + 12 - (x^2 - 7x + 12)}{h} \right]$$

$$\lim_{h \rightarrow 0} \left[\frac{x^2 + 2xh + h^2 - 7x - 7h + 12 - x^2 + 7x - 12}{h} \right]$$

$$\lim_{h \rightarrow 0} \left[\frac{h^2 + 2xh - 7h}{h} \right]$$

$$\lim_{h \rightarrow 0} \frac{2h^2 + 7h + 6 - \cancel{6}}{h}$$

$$= \lim_{h \rightarrow 0} \frac{2h^2 + 7h}{h}$$

$$= \lim_{h \rightarrow 0} \frac{h(2h + 7)}{h}$$

$$= \lim_{h \rightarrow 0} (2h + 7) = \underline{\underline{7}}$$

c) The instantaneous rate of change when $x = 1$ is the same as the value of the derivative when $x =$

4) ⑦ $f(x) = 2x^2 + 3x$
Point $(-2, 2)$

$$f'(x) = \lim_{h \rightarrow 0} \left[\frac{f(x+h) - f(x)}{h} \right]$$

c) The instantaneous rate of change when $x = 1$ is the same as the value of the derivative when $x = 1$

4) ⑦ $f(x) = 2x^2 + 3x$
Point $(-2, 2)$

$$f'(x) = \lim_{h \rightarrow 0} \left[\frac{f(x+h) - f(x)}{h} \right]$$

$$f(x) = 2x^2 + 3x$$

$$f(x+h) = 2(x+h)^2 + 3(x+h)$$

$$f'(x) = \lim_{h \rightarrow 0} \left[\frac{2(x+h)^2 + 3(x+h) - (2x^2 + 3x)}{h} \right]$$

$$\lim_{h \rightarrow 0} \left[\frac{2(x^2 + 2xh + h^2) + 3(x+h) - (2x^2 + 3x)}{h} \right]$$

$$\lim_{h \rightarrow 0} \left[\frac{2x^2 + 4xh + 2h^2 + 3x + 3h - (2x^2 + 3x)}{h} \right]$$

$$\lim_{h \rightarrow 0} \left[\frac{2h^2 + 4xh + 3h}{h} \right]$$

$$\lim_{h \rightarrow 0} \left[\frac{h(2h + 4x + 3)}{h} \right]$$

$$\lim_{h \rightarrow 0} (2h + 4x + 3) = 4x + 3$$

$$4(-2) + 3 = -5 \quad \text{stage}$$

$$\cancel{4(2) + 3 = 11}$$

$$y - y_1 = m(x - x_1)$$

$$y - 2 = -5(x + 2)$$

$$y - (2) = -5(x - (-2))$$

$$6a) \lim_{x \rightarrow 4} \frac{x^2 - 16}{x - 4}$$

$$\lim_{x \rightarrow 4} \frac{4^2 - 16}{4 - 4}$$

$$\lim_{x \rightarrow 4} \frac{16 - 16}{4 - 4}$$

$$= \frac{0}{0} = \infty$$

$$5) \lim_{x \rightarrow 2} (3x^2 + 7x - 16) \\ = 3(2)^2 + 7(2) - 16 = 22$$

b) What is the meaning of this value

~~The limit as x approaches 2~~

As $x \rightarrow 2$, the limit of the equation is 22

$$6) \lim_{x \rightarrow \infty} \frac{8x^3 - 5x^2 + 17}{6x^3 + 2x^2 - 4x}$$

$$\lim_{x \rightarrow \infty} \frac{x^3 \left(8 - \frac{5}{x} + \frac{17}{x^3} \right)}{x^3 \left(6 + \frac{2}{x} - \frac{4}{x^2} \right)}$$

$$\lim_{x \rightarrow \infty} \frac{8 - \frac{5}{x} + \frac{17}{x^3}}{6 + \frac{2}{x} - \frac{4}{x^2}} = \frac{8}{6} = \underline{\underline{\frac{4}{3}}}$$

$$c) \lim_{h \rightarrow 0} \frac{\sqrt{49+h} - 7}{h} = \frac{\sqrt{49+h} + 7}{\sqrt{49+h} + 7}$$

$$\lim_{h \rightarrow 0} \frac{49+h + 7(\sqrt{49+h}) - 7(\sqrt{49+h}) - 49}{h(\sqrt{49+h} + 7)}$$

$$\lim_{h \rightarrow 0} \frac{h}{h(\sqrt{49+h} + 7)}$$

$$\lim_{h \rightarrow 0} \frac{1}{\sqrt{49+h} + 7} = \frac{1}{7+7} = \underline{\underline{\frac{1}{14}}}$$

$$d) \lim_{y \rightarrow 2} \frac{y^3 - 8}{2y^2 - 7y + 12}$$

$$= \frac{2^3 - 8}{2(2)^2 - 7(2) + 12} = \frac{0}{6} = 0$$

$$e) \lim_{h \rightarrow 0} \frac{\frac{4}{2+h} - \frac{2}{1}}{h}$$

$$= \lim_{h \rightarrow 0} \frac{4 - 2(2+h)}{2+h} = \lim_{h \rightarrow 0} \frac{4 - 4 - 2h}{2+h}$$

$$\lim_{h \rightarrow 0} \frac{-2h}{2+h} = \lim_{h \rightarrow 0} \frac{-2h^2}{2h(2+h)} = \frac{0}{2+0} = \frac{0}{2} = 0$$

5)

4 a) $dt = -t^2 + 8t + 1$

2)

The slope is given as $\frac{y_2 - y_1}{x_2 - x_1}$

Let $x_1 = 1$ and $x_2 = 3$

~~$y_2 = -3(2)$~~ $y_2 = (-3)^2 + 8(3) + 1 = 16$

$y_1 = (-1)^2 + 8(1) + 1 = 8$

$\frac{16 - 8}{3 - 1} = \frac{8}{2} = 4$

The rate of change is 4

b) $d(t) = -t^2 + 8t + 1$

At 2 seconds

$x = 2$

$= 2t - 8$

$\frac{dy}{dx} = \frac{f(q+h) - f(q)}{h}$

$q = 2$

$= \left[\frac{2(2+h) - 8 - (2(2) - 8)}{h} \right]$

$= \left[\frac{2(2+h)^2 - 8}{h} \right] - \left[\frac{2(2)^2 - 8}{h} \right]$

$= \frac{2(4 + 2h + h^2) - 8}{h} - \frac{[8 - 8]}{h}$

$= \frac{2h^2 + 4h + 8 - 8}{h}$

$= \frac{h(2h + 4)}{h}$

as $h \rightarrow 0$

$d(2) = 4$

3) A secant line on a curve is a straight line that intersects the curve at two points. To find the [average] rate of change of a function with respect to x between $A(a, f(a))$ and $B(b, f(b))$, following equation is used $(f(b) - f(a)) / (b - a)$

A tangent line to a curve is a straight line that touches the curve at one point. The point where the line touches the curve is called the tangent point. To calculate the instantaneous rate of change at the tangent point, we must calculate the slope of a tangent line.

6

$$\lim_{h \rightarrow 0} \left[\frac{h^2 + 2xh - 7h}{h} \right]$$

$$\lim_{h \rightarrow 0} \left[\frac{h(h + 2x - 7)}{h} \right]$$

$$\lim_{h \rightarrow 0} [h + 2x - 7] = 2x - 7$$

$$m = 2(2) - 7 = -3$$

$$y - y_1 = m(x - x_1)$$

$$y - 2 = -3(x - 2)$$

$$y - 2 = -3x + 6$$

$$\underline{\underline{y = -3x + 8}}$$

(10) (2) $y = 3x^2 + 2x$ parallel to a line
 $y = 10x - 2$

$$m = 10$$

Slope of $y = 3x^2 + 2x$

$$y = x(3x + 2)$$

$$\frac{dy}{dx} = 6x + 2$$

$$6x + 2 = 10$$

$$\frac{6x}{6} = \frac{8}{6}$$

$$x = \frac{8}{6} = 1.333$$

$$y = 3\left(\frac{8}{6}\right)^2 + 2\left(\frac{8}{6}\right)$$

$$y = \frac{32}{6} + \frac{16}{6} = \frac{48}{6} = 8$$

$$= \text{Point} (1.33, 8)$$

①

$$2x^3 + 7x^2 + 2x - 3$$

$$\frac{f(h) - f(a)}{h - a} \quad [4, 6]$$

$$f(3) = 2(3)^3 + 7(3)^2 + 2(3) - 3 = 120$$

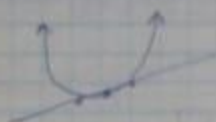
$$f(5) = 2(5)^3 + 7(5)^2 + 2(5) - 3 = 432$$

$$\frac{f(5) - f(3)}{5 - 3} = \frac{432 - 120}{2} = 156$$

②

$$f(x) = 2x^2 + 3x + 1$$

a) Instantaneous
Instant rate of change when $x = 1$



Centered interval of 0.01

$$\frac{0.01}{2} = 0.005$$

At $x = 1$

$$1 + 0.005 = 1.005$$

$$1 - 0.005 = 0.995$$

$$[0.995, 1.005]$$

$$IROC = \frac{f(1.005) - f(0.995)}{1.005 - 0.995}$$

$$f(1.005) = 2(1.005)^2 + 3(1.005) + 1 = 6.03505$$

$$f(0.995) = 2(0.995)^2 + 3(0.995) + 1 = 5.96505$$

$$= \frac{6.03505 - 5.96505}{1.005 - 0.995} = \frac{0.07}{0.01} = 7$$

b) Value of the derivative when $x = 1$

$$y = f(x) = 2x^2 + 3x + 1$$

$$f'(1) = \lim_{h \rightarrow 0} \frac{f(1+h) - f(1)}{h}$$

$$f(1+h) = 2(1+h)^2 + 3(1+h) + 1$$

$$= 2(1+2h+h^2) + 3(1+h) + 1$$

$$= 2 + 4h + 2h^2 + 3 + 3h + 1$$

$$= 2h^2 + 7h + 6$$

$$f(1) = 2(1)^2 + 3(1) + 1$$

$$f(1) = 6$$