23.2

7 $$m_{tan} = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

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

$$= \lim_{h \to 0} \frac{x^2 + 2xh + h^2 - x^2}{h}$$

$$= \lim_{h \to 0} \frac{2xh + h^2}{h}$$

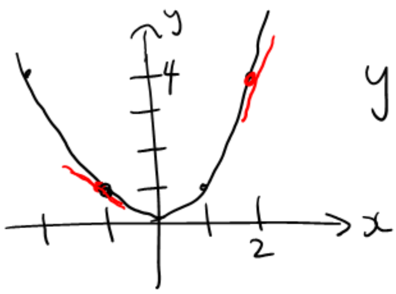
$$= \lim_{h \to 0} \frac{h(2x+h)}{h}$$

$$= \lim_{h \to 0} 2x + h$$

$$= 2x$$

When $x = 2$, $m_{tan} = 4$

$x = -1$, $m_{tan} = -2$



$y = x^2$

⑨ $$m_{tan} = \lim_{h\to 0} \frac{f(x+h)-f(x)}{h}$$

$$= \lim_{h\to 0} \frac{2(x+h)^2 + 5(x+h) - 2x^2 - 5x}{h}$$

$$= \lim_{h\to 0} \frac{2(x^2+2xh+h^2) + 5x + 5h - 2x^2 - 5x}{h}$$

$$= \lim_{h\to 0} \frac{2x^2+4xh+2h^2+5h-2x^2}{h}$$

$$= \lim_{h\to 0} \frac{4xh+2h^2+5h}{h}$$

$$= \lim_{h\to 0} \frac{h(4x+2h+5)}{h}$$

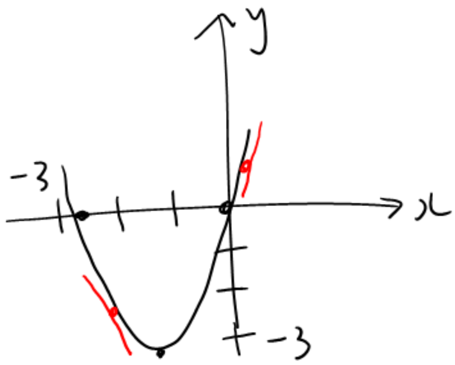
$$= \lim_{h\to 0} 4x+2h+5$$

$$= 4x+5$$

When $x = -2$, $m_{tan} = -3$

$x = 0.5$, $m_{tan} = 7$

Use Wolfram Alpha



(11)

$$m_{tan} = \lim_{h\to 0} \frac{f(x+h)-f(x)}{h}$$

$$= \lim_{h\to 0} \frac{(x+h)^2+4(x+h)+2\pi - x^2-4x-2\pi}{h}$$

$$= \lim_{h\to 0} \frac{x^2+2xh+h^2+4x+4h+2\pi - x^2-4x-2\pi}{h}$$

$$= \lim_{h\to 0} \frac{2xh+h^2+4h}{h}$$

$$= \lim_{h\to 0} \frac{h(2x+h+4)}{h}$$

$$= \lim_{h\to 0} 2x+h+4$$

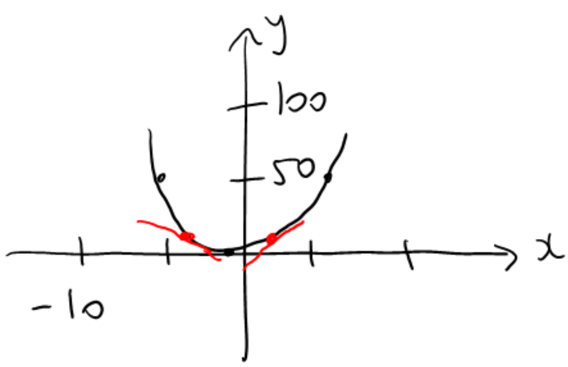
$$= 2x+4$$

When $x=-3$, $m_{tan} = -2$

$x = 2$, $m_{tan} = 8$

Use Wolfram Alpha

$$y = 2x^2+4x+6.28$$



(13) $m_{tan} = \lim_{h \to 0} \dfrac{f(x+h) - f(x)}{h}$

$$= \lim_{h \to 0} \frac{6(x+h) - (x+h)^2 - 6x + x^2}{h}$$

$$= \lim_{h \to 0} \frac{6x + 6h - (x^2 + 2xh + h^2) - 6x + x^2}{h}$$

$$= \lim_{h \to 0} \frac{6x + 6h - x^2 - 2xh - h^2 - 6x + x^2}{h}$$

$$= \lim_{h \to 0} \frac{6h - 2xh - h^2}{h}$$

$$= \lim_{h \to 0} \frac{h(6 - 2x - h)}{h}$$

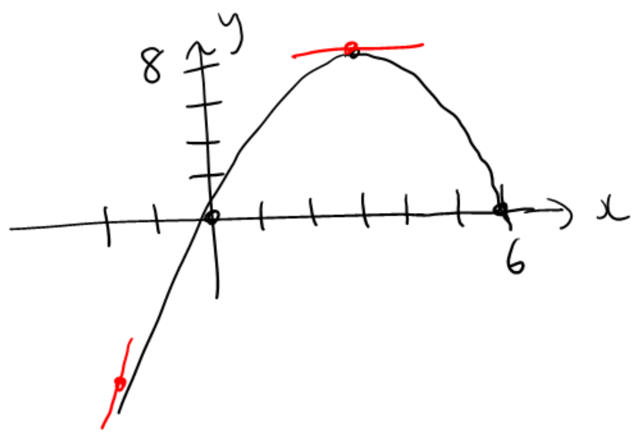
$$= \lim_{h \to 0} 6 - 2x - h$$

$$= 6 - 2x$$

When $x = -2$, $m_{tan} = 10$
$x = 3$, $m_{tan} = 0$

Use Wolfram Alpha

$y = 6x - x^2$



(15) We'll need to expand $(x+h)^4$.

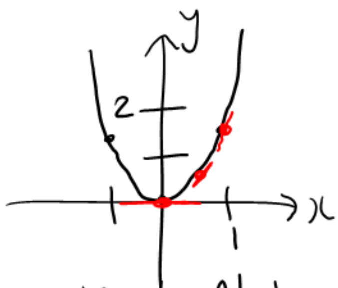
$$\begin{aligned}(x+h)^4 &= (x+h)^2(x+h)^2 \\ &= (x^2+2xh+h^2)(x^2+2xh+h^2) \\ &= x^4+2x^3h+x^2h^2+2x^3h+4x^2h^2+2xh^3 \\ &\quad +x^2h^2+2xh^3+h^4 \\ &= x^4+4x^3h+6x^2h^2+4xh^3+h^4\end{aligned}$$

$$\begin{aligned}m_{tan} &= \lim_{h\to 0}\frac{1.5(x+h)^4-1.5x^4}{h} \\ &= \lim_{h\to 0}\frac{1.5(x^4+4x^3h+6x^2h^2+4xh^3+h^4)-1.5x^4}{h} \\ &= \lim_{h\to 0}\frac{1.5x^4+6x^3h+9x^2h^2+6xh^3+1.5h^4-1.5x^4}{h} \\ &= \lim_{h\to 0}\frac{6x^3h+9x^2h^2+6xh^3+1.5h^4}{h} \\ &= \lim_{h\to 0}\frac{h(6x^3+9x^2h+6xh^2+1.5h^3)}{h} \\ &= \lim_{h\to 0} 6x^3+9x^2h+6xh^2+1.5h^3 \\ &= 6x^3\end{aligned}$$

When $x=0$, $m_{tan}=0$

$x=0.5$, $m_{tan}=0.75$

$x=1$, $m_{tan}=6$



Use Wolfram Alpha