7b) $y = x^2 + \frac{1}{3}x^3$

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

$\frac{dy}{dx} = \tan 135°$

$2x + x^2 = -1$

$x^2 + 2x + 1 = 0$

$(x+1)^2 = 0$

$x = -1$

pt is $\left(-1, \frac{2}{3}\right)$

11a) $y = x^2 - 10x + 9$

$\frac{dy}{dx} = 2x - 10$

when $x = a$, $\frac{dy}{dx} = 2a - 10$

slope of tangent is $2a - 10$

$y - (a^2 - 10a + 9) = (2a - 10)(x - a)$

$y - (a^2 - 10a + 9) = (2a - 10)x - 2a^2 + 10a$

$y = (2a - 10)x - a^2 + 9$

If passes through $(0,0)$

$0 = -a^2 + 9$

$a^2 = 9$

$a = \pm 3$

∴ tangents are

$y = -4x$ and $y = -16x$

13e) $y = \dfrac{3x^2 - 2x + 4}{\sqrt{x}}$

$= \dfrac{3x^2 - 2x + 4}{x^{\frac{1}{2}}}$

$= 3x^{\frac{3}{2}} - 2x^{\frac{1}{2}} + 4x^{-\frac{1}{2}}$

$\dfrac{dy}{dx} = \dfrac{9}{2}x^{\frac{1}{2}} - x^{-\frac{1}{2}} - 2x^{-\frac{3}{2}}$

$= \dfrac{1}{2}x^{-\frac{3}{2}}\left(9x^2 - 2x - 4\right)$

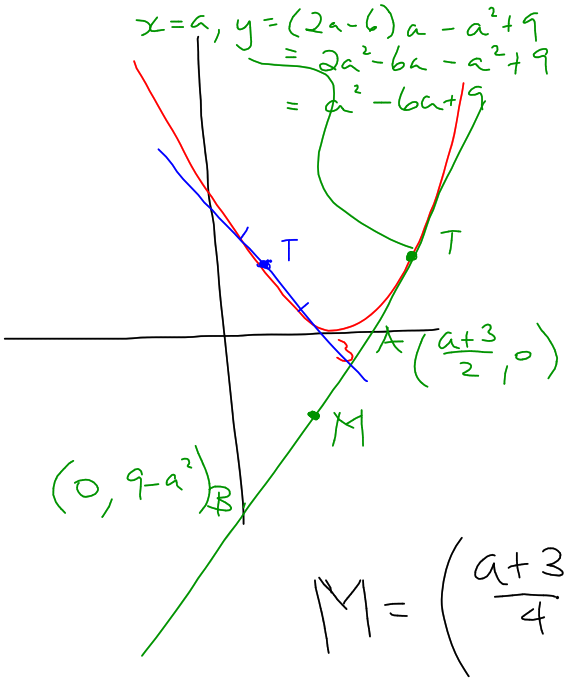
$= \dfrac{9x^2 - 2x - 4}{2x\sqrt{x}}$

22/

$$y = (x-3)^2$$
$$= x^2 - 6x + 9$$
$$\frac{dy}{dx} = 2x - 6$$

when $x = a$, $\frac{dy}{dx} = 2a - 6$

$$y - (a^2 - 6a + 9) = (2a-6)(x-a)$$
$$= (2a-6)x - 2a^2 + 6a$$
$$y = (2a-6)x - a^2 + 9$$



$$y = (2a-6)x - a^2 + 9$$

A: $y = 0$

$$(2a-6)x = a^2 - 9$$

$$x = \frac{(a+3)(a-3)}{2(a-3)}$$

$$x = \frac{a+3}{2}$$

B: $x = 0$

$$y = -a^2 + 9$$

$$M = \left(\frac{a+3}{4}, \frac{9-a^2}{2} \right)$$

$$\alpha = \frac{\alpha + 3}{4}$$

$$4\alpha = \alpha + 3$$

$$3\alpha = 3$$

$$\alpha = 1$$

$$\alpha^2 - 6\alpha + 9 = \frac{9 - \alpha^2}{2}$$

$$2\alpha^2 - 12\alpha + 18 = 9 - \alpha^2$$

$$3\alpha^2 - 12\alpha + 9 = 0$$

$$\alpha^2 - 4\alpha + 3 = 0$$

$$(\alpha - 3)(\alpha - 1) = 0$$

$$\alpha = 3 \text{ or } \alpha = 1$$

$$\therefore \alpha = 1$$