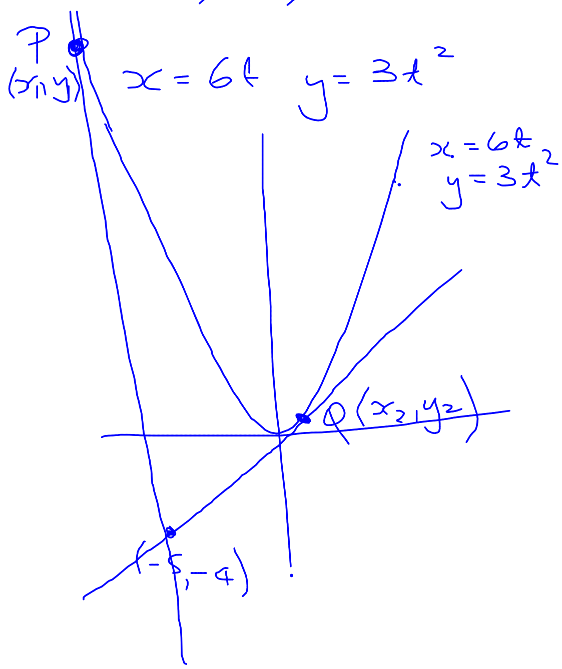
2d) $(-5,-4)$



$x = 6t \qquad y = 3t^2$

$t = \frac{x}{6} \qquad y = \frac{x^2}{12}$

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

at P_1 $\frac{dy}{dx} = \frac{x_1}{6}$

$y - y_1 = \frac{x_1}{6}(x - x_1)$

$6y - 6y_1 = x_1 x - x_1^2$

$= x_1 x - 12y_1$

$\underline{x_1 x = 6y + 6y_1}$

But $(-5,-4)$ lies on tangent

$\therefore -5x_1 = -24 + 6y_1$

$5x_1 + 6y_1 - 24 = 0$

tangent at Q is $x_2 x = 6y + 6y_2$

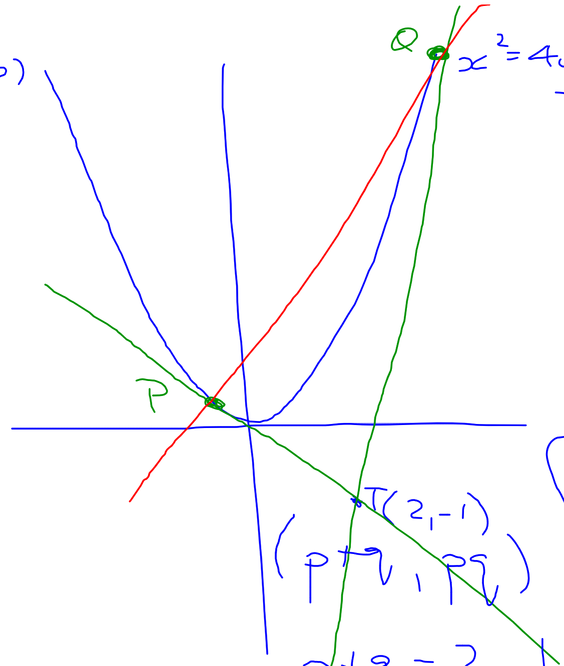
$(-5, 4)$ lies on this tangent

$\therefore 5x_2 + 6y_2 - 24 = 0$

(x_1, y_1) and (x_2, y_2) lie on the line PQ

PQ is $\underline{5x + 6y - 24 = 0}$

6b)



$p+q=2$

$pq=-1$

PQ: $(p+q)x-2y=2pq$

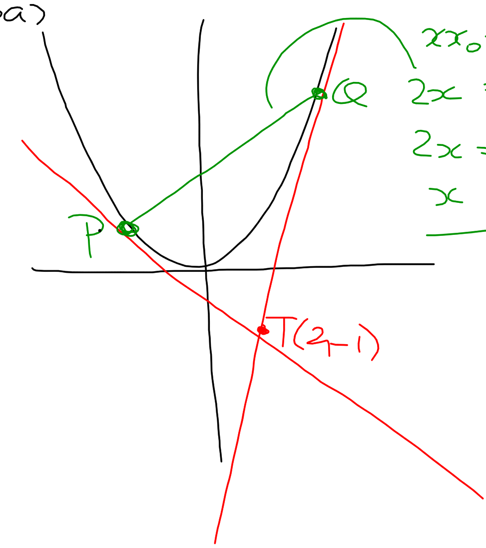
$2y=(p+q)x-2pq$

$x^2=2(p+q)x-4pq$

$x^2-2(p+q)x+4pq=0$

$x^2-4x-4=0$

6a)



$xx_0 = 2a(y + y_0)$

$2x = 2\cdot(y - 1)$

$2x = 2y - 2$

$x - y + 1 = 0$

b) $x^2 = 4(x+1)$

$x^2 - 4x - 4 = 0$

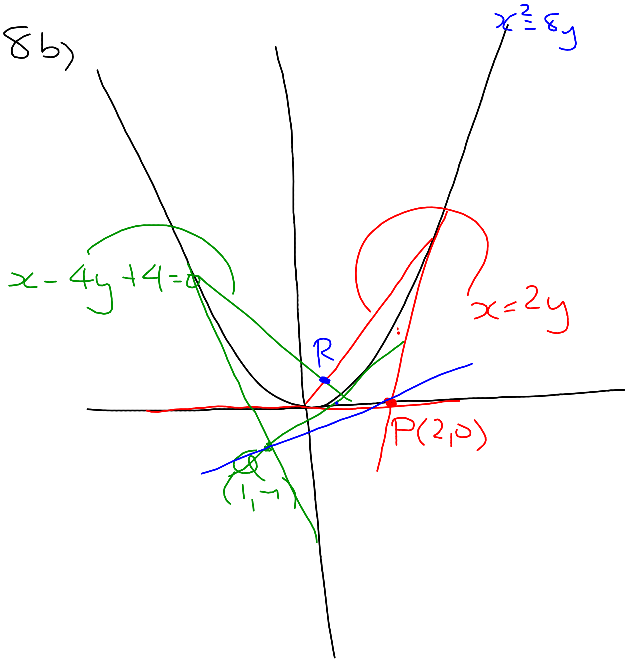
c) $\alpha + \beta = 4$

d) $x_m = \frac{\alpha+\beta}{2}$ $\quad y_m = x_m + 1$

$= 2$ $\quad = 3$

M is $(2,3)$

8b)



$$x = 2y$$
$$\underline{x - 4y + 4 = 0}$$
$$2y - 4y + 4 = 0$$
$$2y = 4$$
$$y = 2$$

$\therefore$ R is (4,2)

$x^2 = 16 \qquad 8y = 16$

$\therefore$ R lies on parabola

$m_{PQ} = \frac{0+1}{2-1}$

$= \frac{1}{1}$

$= 1$

$y - 0 = \cdot 1(x-2)$

$y = \cdot\ x - 2$

$x^2 = 8(x-2)$

$x^2 = 8x - 16$

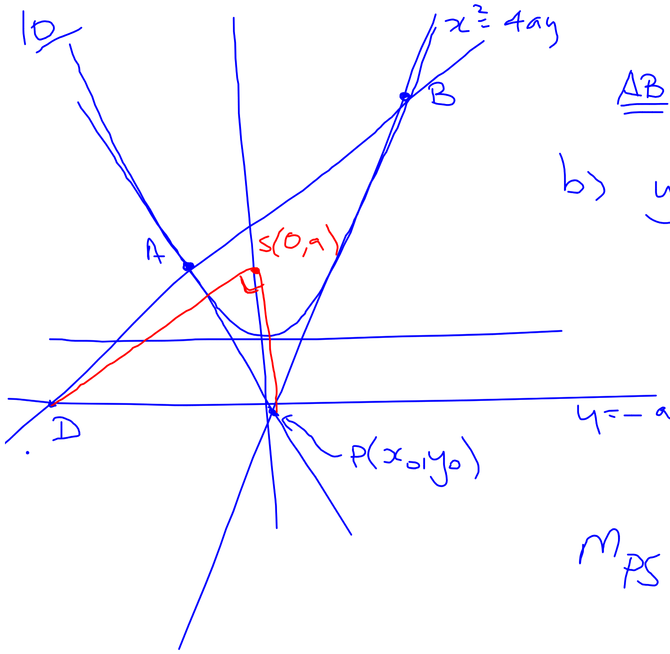
$x^2 - 8x + 16 = 0$

$(x-4)^2 = 0$

$x = 4$

$\therefore$ PQ intersects (touches) parabola at R.

10



$\underline{AB}$: $x x_0 = 2a(y + y_0)$

b) $y = -a$, $x x_0 = 2a(-a + y_0)$

$$x = \frac{2a(-a + y_0)}{x_0}$$

$$\therefore D \text{ is } \left\{ \frac{2a(y_0 - a)}{x_0}, -a \right\}$$

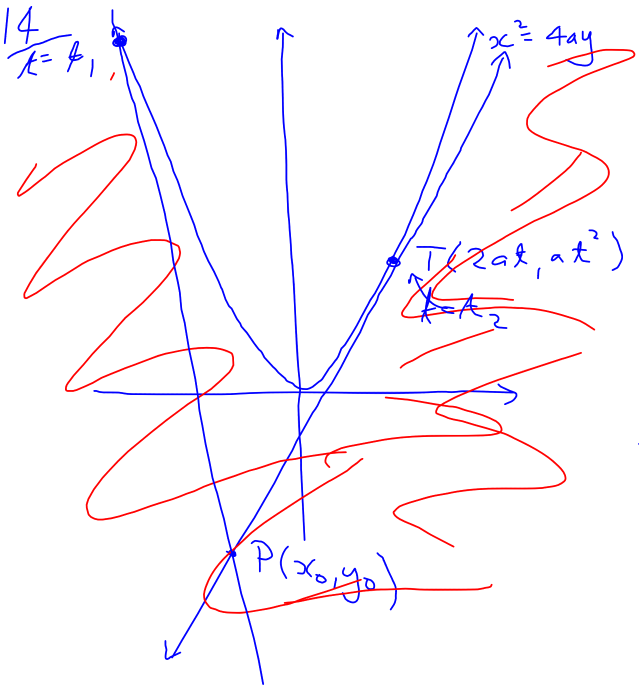
$$m_{PS} \times m_{DS} = \frac{y_0 - a}{x_0} \times \frac{-a-a}{\frac{2a(y_0 - a)}{x_0}}$$

$$= \frac{y_0 - a}{x_0} \times \frac{-2a x_0}{2a(y_0 - a)}$$

$$= -1$$

$\therefore \underline{PS \perp DS}$

14



$y = \frac{x^2}{4a}$

$\frac{dy}{dx} = \frac{2x}{4a}$

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

when $x = 2at$, $\frac{dy}{dx} = t$

$y - at^2 = t(x - 2at)$

$y - at^2 = tx - 2at^2$

$\underline{y = tx - at^2}$

b) $\underline{(x_0, y_0)}$: $y_0 = tx_0 - at^2$

$\underline{at^2 - x_0 t + y_0 = 0}$

c) $\Delta > 0$

$x_0^2 - 4ay_0 > 0$

$x_0^2 > 4ay_0$

d) $(2at_1, at_1^2)$

$(2at_2, at_2^2)$

$$m = \frac{at_1^2 - at_2^2}{2at_1 - 2at_2}$$

$$= \frac{a(t_1 - t_2)(t_1 + t_2)}{2a(t_1 - t_2)}$$

$$= \frac{t_1 + t_2}{2}$$

$$y - at_1^2 = \frac{t_1 + t_2}{2}(x - 2at_1)$$

$$2y - 2at_1^2 = (t_1 + t_2)x - 2at_1^2 - 2at_1t_2$$

$$(t_1 + t_2)x = 2y + 2at_1t_2$$

(ii) $t_1 + t_2 = \frac{x_0}{a}$ (sum of roots)

$$t_1 t_2 = \frac{y_0}{a}$$

(iii) $\frac{x_0 x}{a} = 2y + 2y_0$

$$xx_0 = 2a(y + y_0)$$