10.

$f(x) = ax^2 + bx + c$

$f'(x) = 2ax + b$

$f'(x) = 0$

$2ax + b = 0$

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

$\therefore$ tangent is horizontal at the AOS.

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a) $\alpha = \frac{1}{2}(\sqrt{5}+1)$

(i) $\alpha^2 = \frac{1}{4}(\sqrt{5}+1)^2$

$= \frac{1}{4}(5+2\sqrt{5}+1)$

$= \frac{1}{4}(6+2\sqrt{5})$

$= \frac{1}{2}(3+\sqrt{5})$

$= \alpha+1$

(ii) $\frac{1}{\alpha} = \frac{2}{\sqrt{5}+1} \times \frac{\sqrt{5}-1}{\sqrt{5}-1}$

$= \frac{2\sqrt{5}-2}{4}$

$= \frac{1}{2}(\sqrt{5}-1)$

$= \alpha-1$

(iii) $\alpha^6 = (\alpha^2)^3$

$= (\alpha + 1)^3$

$= \alpha^3 + 3\alpha^2 + 3\alpha + 1$

$= \alpha(\alpha+1) + 3(\alpha+1) + 3\alpha + 1$

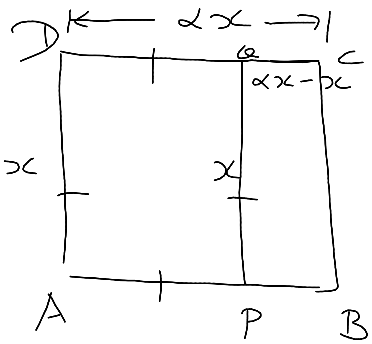
$= \alpha^2 + \alpha + 3\alpha + 3 + 3\alpha + 1$

$= \alpha^2 + 7\alpha + 4$

$= \alpha + 1 + 7\alpha + 4$

$= \underline{8\alpha + 5}$

b)



$$\frac{PQ}{QC} = \frac{x}{\alpha x - x}$$

$$= \frac{1}{\alpha - 1}$$

$$= \frac{1}{\frac{1}{\alpha}}$$

$$= \frac{\alpha}{1}$$