

$$8) \quad r(t) = (2t^3 - 3t^2)i + (t^3 - 12t)j$$

i) tangent line equation  $\frac{dy}{dx}$ ,  $x$ ,  $y$ ,  $t$

$$r(-1) = (-2 - 3)i + (-1 + 12)j = -5i + 11j$$

$$\frac{dy}{dx} = \frac{dy/dt}{dx/dt} = \frac{3t^2 - 12}{6t^2 - 6t} \quad \left/ \frac{dy}{dx} \right|_{t=-1} = \frac{3 - 12}{6 + 6} = \frac{-9}{12} = \frac{-3}{4}$$

Point-slope  $\Rightarrow$   $y - 11 = -\frac{3}{4}(x + 5)$

ii) Horizontal component  $6t^2 - 6t = 0$

$$6t^2 - 6t = 0 \rightarrow 6t(t - 1) = 0 \quad \begin{matrix} t = 0 \\ t = 1 \end{matrix}$$

$$r(0) = (0, 0)$$

$$r(1) = (-1, -11)$$

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iii)  $r''(t) = a(t) = (12t - 6)i + (6t)j$

$$r''(2) = a(2) = (24 - 6)i + (12)j = 18i + 12j$$

$$\langle 18, 12 \rangle$$