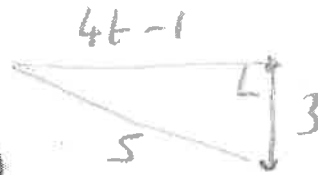


Homework 2 Solutions

$$1) \quad r(t) = (2t^2 - t)\underline{i} - (3t + 1)\underline{j} \quad (1)$$

$$v(t) = (4t - 1)\underline{i} - 3\underline{j} \quad \checkmark$$

speed = 5 ms^{-1} so



$$(4t - 1)^2 + 3^2 = 5^2 \quad \checkmark \quad (1)$$

$$(4t - 1)^2 = 16 \quad \checkmark \quad (1)$$

$$4t - 1 = \pm 4 \quad \checkmark$$

$$4t = 5 \quad \checkmark \quad (1)$$

$$\underline{t = 5/4} \quad \checkmark \quad \text{since } t > 0$$

$$2) a) \quad v(t) = 3(t^2 - 4t + 2)\underline{i} + 4\underline{j}$$

$$a(t) = (6t - 12)\underline{i} \quad \checkmark \quad (1)$$

acceleration = 0 when t = 2 seconds \checkmark (1)

$$b) \quad v(t) = (3t^2 - 12t + 6)\underline{i} + 4\underline{j} \quad \checkmark \quad (1)$$

$$s(t) = (t^3 - 6t^2 + 6t)\underline{i} + 4t\underline{j} + C \quad \checkmark$$

$$\text{at } t=0 \quad s = -4\underline{j} \quad -4\underline{j} = C$$

$$s(t) = (t^3 - 6t^2 + 6t)\underline{i} + (4t - 4)\underline{j} \quad \checkmark \quad (1)$$

$$\text{at } t=2 \quad s(t) = -4\underline{i} + 4\underline{j} \quad \checkmark \quad (1)$$

$$|s| = \sqrt{4^2 + 4^2} = \underline{4\sqrt{2} \text{ m}} \quad \checkmark \quad (1)$$

$$3) \quad r(t) = \left(\frac{1}{3}t^3 - 4t^2\right)\underline{i} - (2t^2 - 1)\underline{j}$$

$$v(t) = (t^2 - 8t)\underline{i} - 4t\underline{j} \quad \checkmark \quad (1)$$

$$a(t) = (2t - 8)\underline{i} - 4\underline{j} \quad \checkmark \quad (1)$$

at $t = 4$ $a(t) = -4\underline{j}$ so parallel to the y -axis $\checkmark \quad (1)$

$$v(t) = (t^2 - 8t)\underline{i} - 4t\underline{j}$$

$$\text{at } t = 4 \quad v(t) = -16\underline{i} - 16\underline{j} \quad \checkmark \quad (1)$$

$$|v| = \sqrt{16^2 + 16^2}$$

$$= \underline{16\sqrt{2} \text{ ms}^{-1}} \quad \checkmark \quad (1)$$

$$4) \quad r(t) = (3t^2 - 12t + 5)\underline{i} + (4t - t^2)\underline{j}$$

$$v(t) = (6t - 12)\underline{i} + (4 - 2t)\underline{j} \quad \checkmark \quad (1)$$

at $t = 2$ $\checkmark \quad (1)$ $v(t) = 0$ so at instantaneous rest.

$$r(t) = (3t^2 - 12t + 5)\underline{i} + (4t - t^2)\underline{j}$$

$$\text{at } t = 2 \quad r(t) = -7\underline{i} + 4\underline{j} \quad \checkmark \quad (1)$$

$$|r(t)| = \sqrt{7^2 + 4^2}$$

$$= \underline{8.1 \text{ ms}^{-1}} \quad \checkmark \quad (1)$$

5) $v(t) = 3t(2-t)j$

$v(t) = (6t - 3t^2)j$

$a(t) = (6 - 6t)j$ ✓ (1)

at $t=1$ $a(t)=0$ so reached max velocity ✓ (1)

$v(t) = (6t - 3t^2)j$

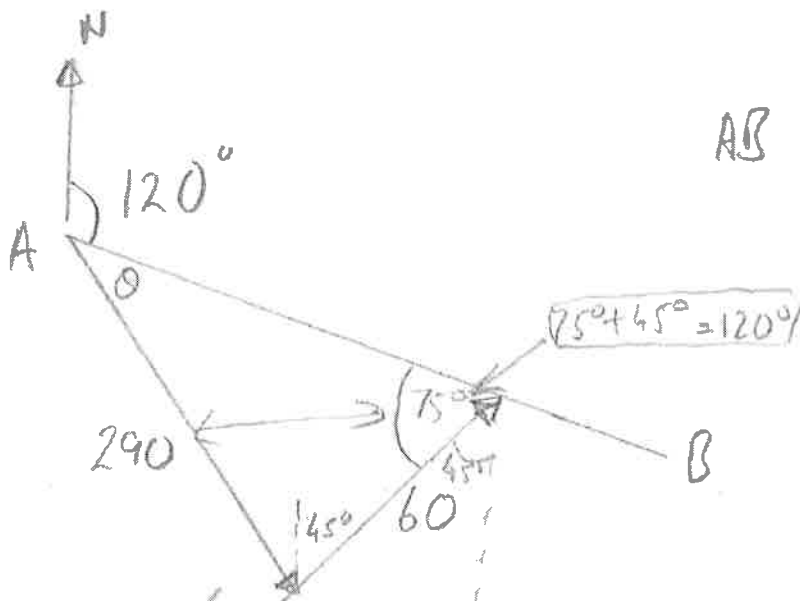
$s(t) = (3t^2 - t^3)j + C$

at $t=0$ $s=3j \Rightarrow 3j = C$

$s(t) = (3t^2 - t^3 + 3)j$ ✓ (1)

at $t=1$ $s=5j \Rightarrow$ distance = 5m ✓ (1)

6)

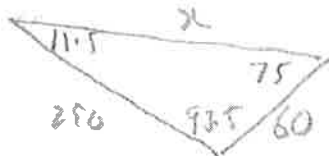


$AB = 2000 \text{ km}$

$\frac{\sin \theta}{60} = \frac{\sin 75}{290}$ ✓ (1)

$\sin \theta = \frac{60 \sin 75}{290}$

$\theta = 11.5^\circ$ ✓ (1)



use cosine rule ✓ (1)

$x^2 = 60^2 + 290^2 - 2 \times 60 \times 290 \times \cos 93.5$

$x = 299.7 \text{ km/h}$ ✓ (1)

$t = \frac{d}{s} = \frac{2000}{299.7} = 6.67 \text{ hrs}$
 $= 6 \text{ hrs } 40 \text{ mins}$ ✓ (1)

