~~umuten~~.github.io
umutech
...lol

Section A (36 marks)

1 (i)

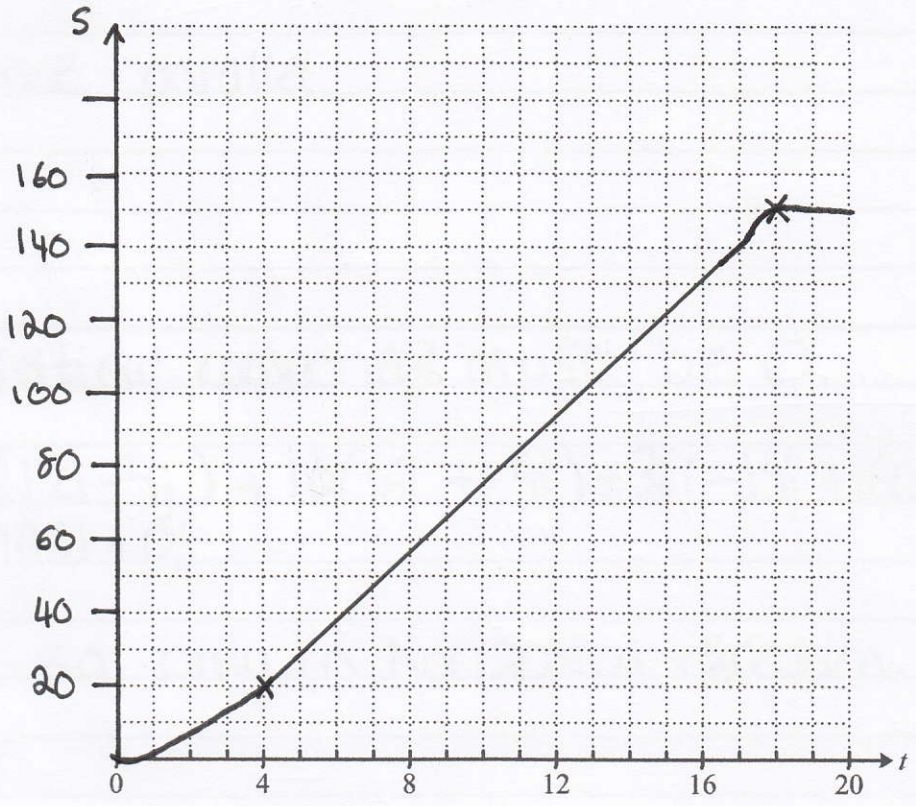
When $t=4$, area under graph is 's' or displacement.
$\frac{1}{2}(4 \times 10) = 20\text{m}$

When $t=18$, area under graph
$20 + (\blacksquare(12 \times 10)) + (\frac{1}{2}(2 \times 10))$
$= 20 + 120 + 10 = 150\text{m}$

When $t=$ 4 , $s=20\text{m}$

When $t=18$, $s=150$

1 (ii)



At $t=4$, $s=20$ ✓ , At $t=18$, $s=150$ ✓

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2 (i)

If one vector is a multiple of another, they are parallel!

$p = 12i - 5j \quad q = 16i + 1.5j$

$p + q = 12i + 16i - 5j + 1.5j$

$p + q = 28i - 3.5j.$

$28i - 3.5j = K(8i - j)$

$K = \frac{28i}{8i}$, $K = \frac{-3.5j}{-j}$ so $K = 3.5$

$\therefore$ hence parallel.

2 (ii)

Vertical component must be 0.

$3(12i - 5j) + 10(16i + 1.5j) = 36i - 15j + 160i + 15j$
$= 196i + 0j$

$0j$ so only in horizontal direction.

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2 (iii)

Horizontal component:

$K(12i) + 3(16i) = 0$

$12K + 36 = 0$

$12K = -36$

$K = \frac{-36}{12} = \underline{\underline{-4}}$

Weight only acts in Vertical component:

Vertical Component:

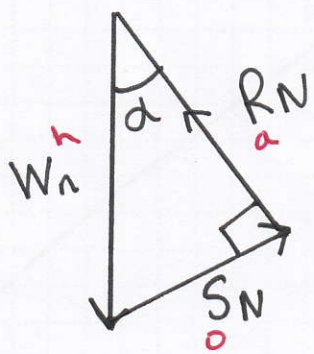
$-4(-5j) + 3(1{\cdot}5j) = 20 + 4{\cdot}5 + W = 0$

$20 + 4{\cdot}5 + W = 0, \quad 24{\cdot}5 + W = 0$

$W = -24{\cdot}5, \quad W = mg$

$mg = -24{\cdot}5, \quad m = \frac{-24{\cdot}5}{9} \quad \underline{\underline{m = 2{\cdot}5 \text{ kg}}}$

3 (i)



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3 (ii)

Soh, Cah, Toa

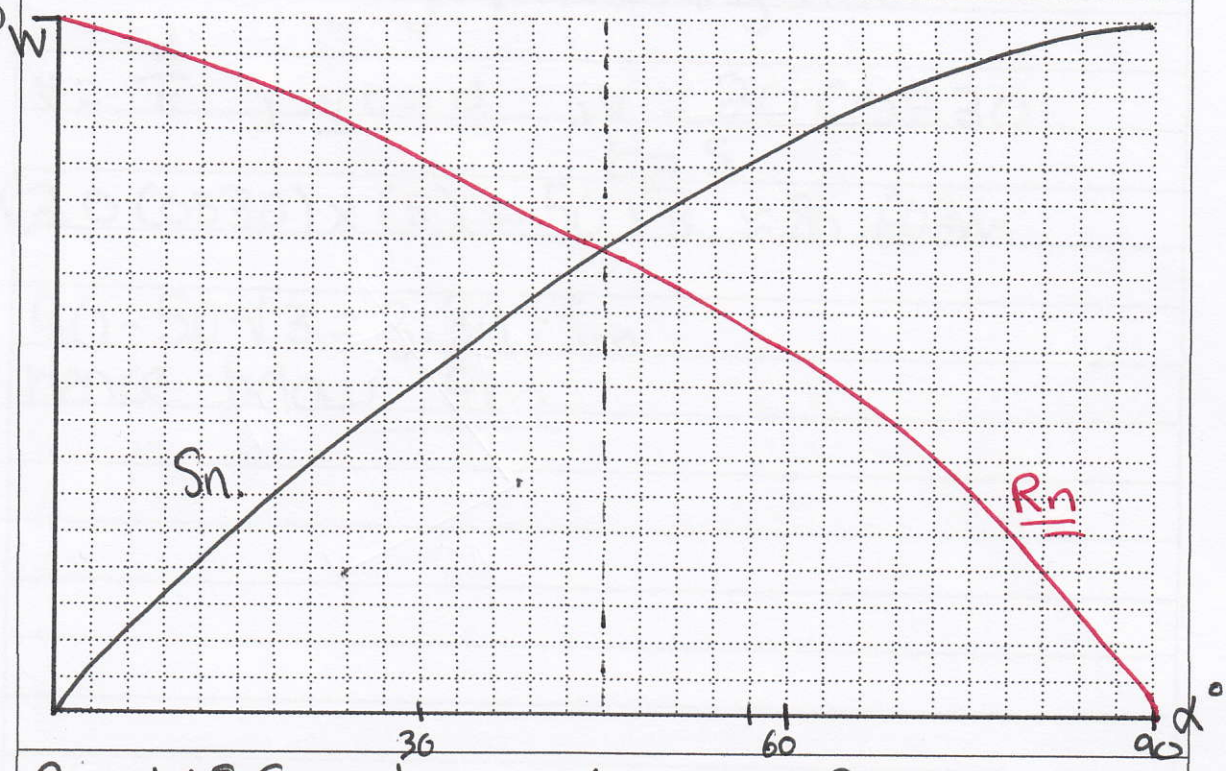
SO FOR R:

$R_n = W \cos\alpha$

For S_n

$S_n = W \sin\alpha$

3 (iii)



$R_n = W \cos\alpha$

$S_n = W \sin\alpha$

They are Sine and Cosine function:

They intersect at 45° so... $\alpha > 45^\circ$

$45^\circ < \alpha \leq 90^\circ$

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4 (i) Verify.

$s = s_0 + ut + \frac{1}{2}at^2$

$0 = 75 + (20\sin 30)t - 5t^2$

$s_0 = 75m$
$s = 0$
$u = 20\sin 30$
$v = 0$
$a = -10 ms^{-2}$
$t = ?$

We solve quadratic...

$(t - 5)(t + 3)$

$\therefore t = 5$

Now, we want displacement, just use horizontal way of working out!

$v = \frac{d}{t}$, $vt = d$, $v = 20\cos 30$, $t = 5$

$(20\cos 30) \times (5) = 50\sqrt{3} \approx 86.603m$

$90 - 50\sqrt{3} = 3.3975m$

hence below 5m

(answer space continued on next page)

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4 (i)	**(continued)**
4 (ii)	It will have less acceleration downwards so it will be in the air much longer hence it will travel further.

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5 (i)

$v = 37500(4t - t^2)$ { ($v = 0$ on arrival)

$(37500t)(4 - t) = 0$

hence $t = 4$ hours

5 (ii)

Find expression for distance...

We intergrate!

$v = 37500(4t - t^2) = 150{,}000t - 37500t^2$

$\frac{150{,}000}{2}t^2 - \frac{37500}{3}t^3 + c$

$s = 75{,}000t^2 - 125{,}00t^3$

When $t = 4 \rightarrow 75000(4^2) - 12500(4^3)$

$120{,}0000 - 80{,}0000 = 400{,}000$ km

5 (iii)

Imagine ($v = 37500(4t - t^2)$ like a quadratic, when gradient is zero, it is at a max point... $v = 150{,}000t - 37500t^2$

$\frac{dy}{dx} = \frac{dv}{dx} = 150{,}000 - 75000t$

Let $\frac{dy}{dx} = 0$, $150{,}000 - 75000t = 0$

$150{,}000 = 750{,}00t$

$t = 150{,}000 / 75{,}000 = 2$ hours

At two hours, it is at max speed.

$V = 375{,}00(4(2) - (2)^2) = 150{,}000$ Km/h

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