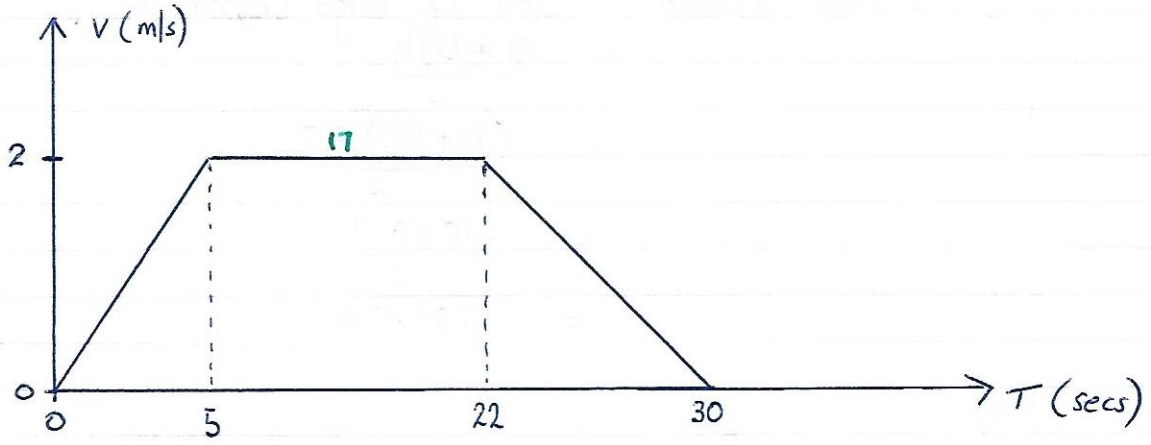
V/T Graphs with Lifts : Answers

1) a) $u = 0$ m/s
$a = 0.4$ m/s^2
$v = 2$ m/s

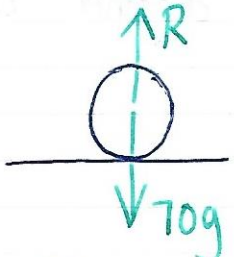
$v = u + at$
$2 = 0 + 0.4t$
$\frac{2}{0.4} = t$
5 secs $= t$ is time spent accelerating

b)



c) Dist travelled = area under trapezium graph
$= \frac{(a+b)h}{2}$
$= \frac{(17+30)2}{2}$
$= 47$ m

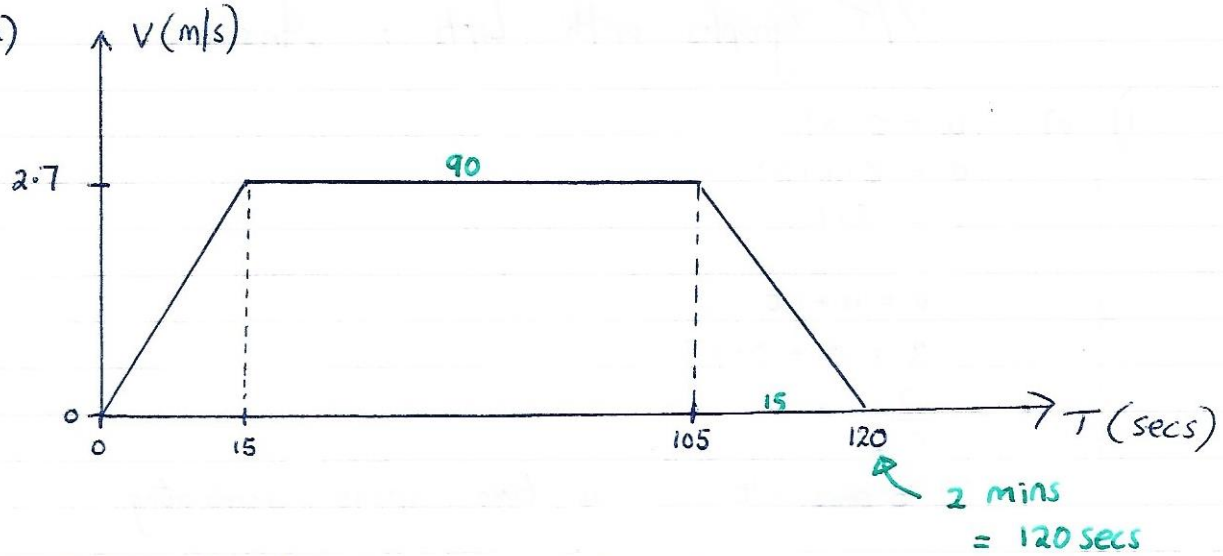
d)



↑ $a = 0.4$ m/s^2

$Rf = ma$ for man
$R - 70g = 70(0.4)$
$R = 28 + 70(9.8)$ ← Man is 28 N heavier than 'normal' weight
$R = 28 + 686$
$R = 714$ N

2) a)



b) Distance travelled = area of large trapezium

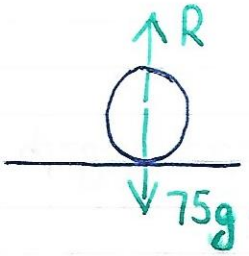
$$= \frac{(a+b)h}{2}$$

$$= \frac{(90+120)\,2{\cdot}7}{2}$$

$$= \frac{210 \times 2{\cdot}7}{2}$$

$$= 283{\cdot}5\ \text{m}$$

c)



$\uparrow a = ?$

First find acceleration from V/T graph.

Acc = Gradient of first diagonal line

$$= \frac{2{\cdot}7}{15}$$

$$= 0{\cdot}18\ \text{m/s}^2$$

Now RF = ma for woman

$$R - 75g = 75(0{\cdot}18)$$

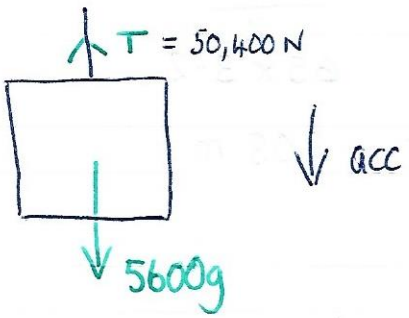
$$R = 13{\cdot}5 + 75(9{\cdot}8)$$

$$R = 13{\cdot}5 + 735$$

$$R = 748{\cdot}5\ \text{N}$$

3) a) $t = 8$ secs
$u = 0$ m/s
$a = ?$

First find acceleration



$RF = ma$ for lift

$5600g - T = 5600a$

$5600(9.8) - 50400 = 5600a$

$\div 100$

$56(9.8) - 504 = 56a$

$548.8 - 504 = 56a$

$\frac{44.8}{56} = a$

$0.8 \text{ m/s}^2 = a$ QED

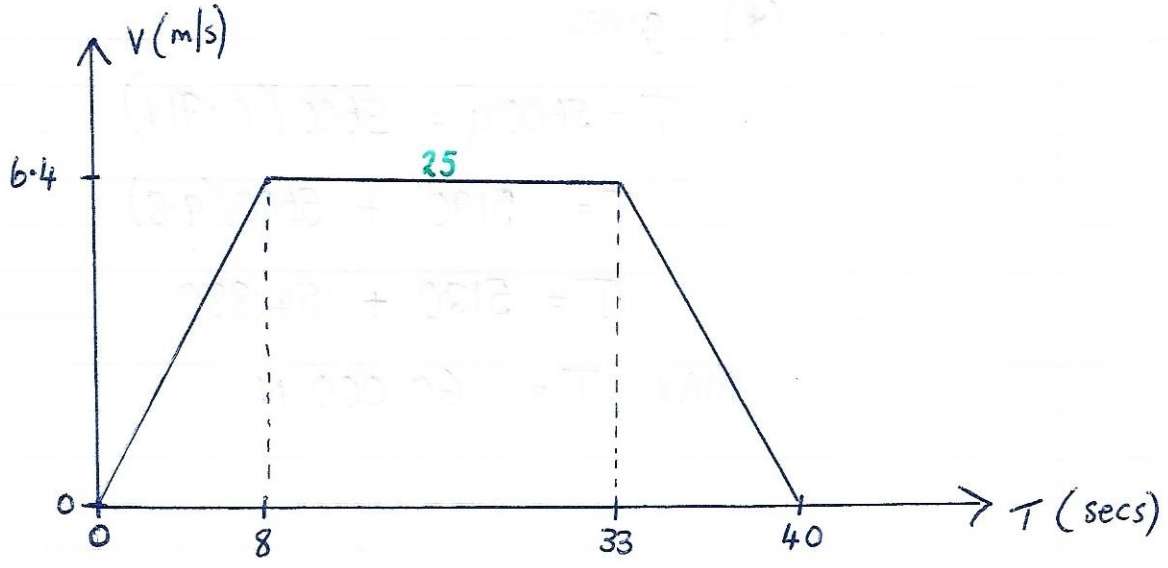
b) $u = 0$ $a = 0.8$
$t = 8$ $v = v$

$v = u + at$

$v = 0 + 0.8(8)$

$v = 6.4$ m/s

c)



d) Total distance = area under trapezium

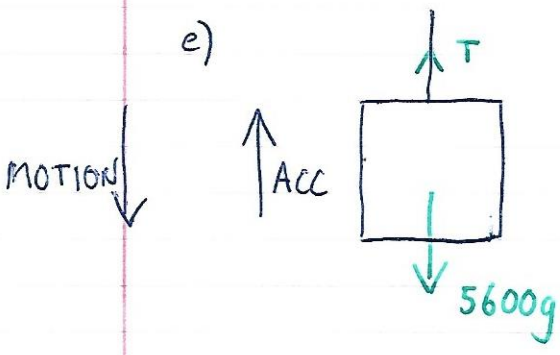
$$= \frac{(a+b)h}{2}$$

$$= \frac{(25+40)}{2} \times 6.4$$

$$= 65 \times 3.2$$

$$= 208 \text{ m}$$

e)



Max tension when ~~acc upward~~ the lift is decelerating at end of the journey

$Rf = ma$ for Lift

$T - 5600g = 5600(a)$ (*)

We need the retardation value from V/T graph

Retardation = Gradient of \

$$= \frac{6.4}{7}$$

$$= 0.914 \text{ m/s}^2$$

∴ (*) gives

$$T - 5600g = 5600(0.914)$$

$$T = 5120 + 5600(9.8)$$

$$T = 5120 + 54\,880$$

MAX $T = 60\,000$ N