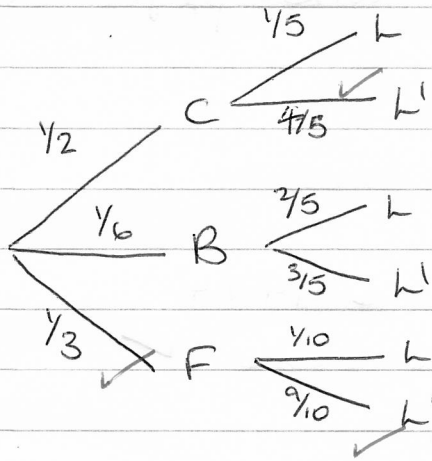


Prachise Paper E

Section A: Statistics.

- 1a) An observation/measurement of every member of a population. ✓
b) Takes a long time / costly ✓
Difficult to ensure whole population surveyed ✓
could involve testing to destruction ✓
could be hard to manage + analyse all data ✓
c) list of all unique serial numbers ✓
d) The circuit boards. ✓

2a)

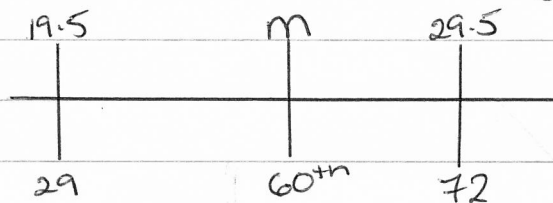


b) $\frac{1}{3} \times \frac{1}{10} = \frac{1}{30}$ ✓

$\frac{1}{2} \times \frac{4}{5} + \frac{1}{6} \times \frac{3}{5} + \frac{1}{3} \times \frac{9}{10}$
 $= \frac{4}{5}$ ✓

3)a) Estimate \Rightarrow interpolate

$\frac{120}{2} = 60^{\text{th}}$ in 20-29 group.



$$\frac{m-19.5}{29.5-19.5} = \frac{60-29}{72-29}$$

$\Rightarrow m = 19.5 + \frac{31}{43} \times 10$

$= 26.7$ ✓

b) $\bar{x} = \frac{\sum fx}{\sum f} = \frac{3552.5}{120} = 29.6$ ✓

$$\sigma = \sqrt{\frac{\sum fx^2}{\sum f} - \bar{x}^2} = \sqrt{\frac{138043.125}{120} - \left(\frac{3552.5}{120}\right)^2}$$

$= 16.6$ ✓

c) A few large values distort the mean. ✓

d) Devon $\bar{x} = 29.6$ $\sigma_x = 16.6$

G. London $\bar{y} = 15.6$ $\sigma_y = 21.2$

In Devon the mean is larger as people need to travel further to work in the countryside. OR the mean for London is smaller as places are closer together. The s.d. for Devon is smaller as there is less variation in where you can travel to OR in London the s.d. is larger as there is more variability in where people can travel to

4) a) $X \sim \text{Bin}(20, 0.05)$

b) $P(X=0) = 0.3584$

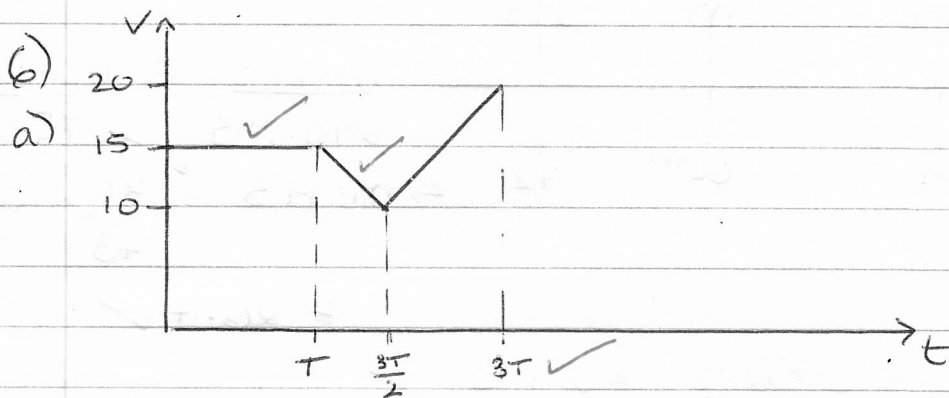
c) $P(X > 4) = 1 - P(X \leq 4) = 1 - 0.9974 = 0.0026$

Section B: Mechanics

5) a) 5.3 ms^{-1} (\rightarrow)

b) -4.8 ms^{-1} (\leftarrow)

c) -30 m (\leftarrow)



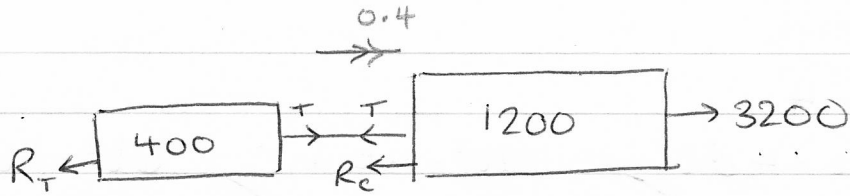
b) Area = 1312.5

$$15 \times T + \frac{1}{2} (15+10)T + \frac{1}{2} (10+20) \times 3T = 1312.5$$

$$\Rightarrow 15T + \frac{25}{2}T + \frac{90}{2}T = 1312.5$$

$$\Rightarrow T = 30 \text{ seconds}$$

7) a)



$$R_T \times 400 = R_C \times 1200$$

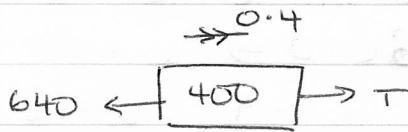
$$\Rightarrow R_T = 400k \quad \Rightarrow R_C = 1200k \quad F=ma \checkmark$$

$$3200 - 1600k = 1600 \times 0.4 = 640$$

$$1600k = 2560$$

$$k = 1.6 \Rightarrow R_T = 640 \checkmark$$

b)

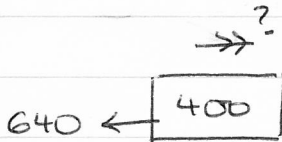


$$F = ma$$

$$T - 640 = 400 \times 0.4 \checkmark$$

$$T = 800N \checkmark$$

c)



$$F = ma$$

$$-640 = 400a \checkmark$$

$$a = -1.6 \text{ ms}^{-2}$$

$$s = ?$$

$$u = 25$$

$$v = 0$$

$$a = -1.6 \text{ ms}^{-2}$$

$$v^2 = u^2 + 2as \checkmark$$

$$0^2 = 25^2 + 2(-1.6)s \checkmark$$

$$-625 = -3.2s \quad s = 195m \checkmark$$

d) car and trailer move as one or car + trailer have same acceleration

8)

$$s = 2$$

$$u = ?$$

$$v = ?$$

$$a = 12 \times 1 - 4 = 8$$

$$t = 1$$

$$s = 30$$

$$u = ?$$

$$v = ?$$

$$a = 12 \times 3 - 4 = 32$$

$$t = 3$$

variable acceleration so can't use surat.

acceleration \rightarrow velocity \rightarrow displacement.

$$a = 12t - 4$$

$$v = \int 12t - 4 dt = \frac{12t^2}{2} - 4t + c = 6t^2 - 4t + c$$

$$s = \int 6t^2 - 4t + c dt = \frac{6t^3}{3} - \frac{4t^2}{2} + ct + d$$

$$s = 2t^3 - 2t^2 + ct + d$$

Sub in values.

$$t = 1, s = 2 \Rightarrow 2 = 2 - 2 + c + d \Rightarrow c + d = 2$$

$$t = 3, s = 30 \Rightarrow 30 = 54 - 18 + c + d \Rightarrow 3c + d = -6 \checkmark$$

$$\therefore 2c = -8 \Rightarrow c = -4 \quad d = 6 \checkmark$$

$$\text{now } s = 2t^3 - 2t^2 - 4t + 6 \checkmark$$

$$\text{when } t = 2 \quad s = 2 \times 2^3 - 2 \times 2^2 - 4 \times 2 + 6 = 6 \checkmark$$