2. Linear motion

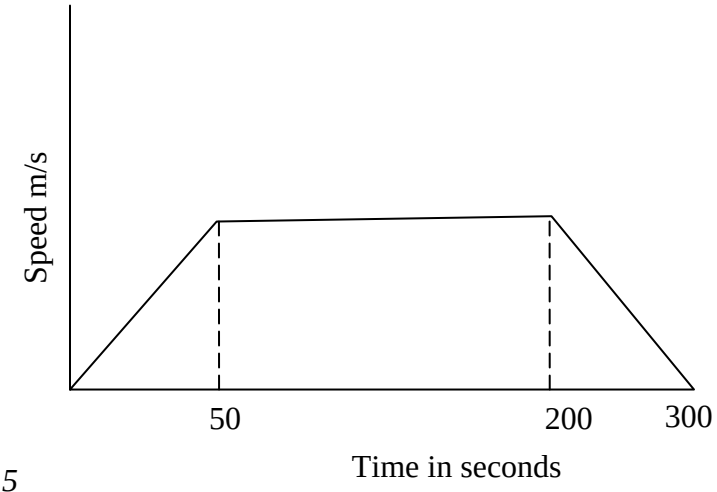
1. Distance covered by Kinyua in $1\frac{2}{3}$hrs
= 5 x 90 = 150km
Distance traveled by Nyaboke during the rest = ($\frac{1}{3}$ x 120) = 40km
$\frac{x}{90} = \frac{390 - x}{120} \Rightarrow 120x = 90(390 - x)$
= 167.1km
Time = $\frac{167.1}{90}$ = 1.86
8.33 + 1.86 = 10.19; they met at = 10.11a.m
580 – (150 + 167 .1) = 262.9km from M
Before the rally driver started, Nyaboke had traveled for 1 ½ hrs
($\frac{3}{2}$ x 120) = 180km
$\frac{x}{120} = \frac{x + 180}{80}$
180x – 120x = 21600
x = 360km
Distance from K = 580 – (180 + 360)
x = 40km
Time = $\frac{540}{180}$ = 3hrs
(9.30 + 3hrs) = 12.30p.m

2. Distance covered by the car after 15 min =(¼ x 80)km = 20km
Distance covered together = 130km
Relative speed = (80 + 40) = 120km/h
Time taken to meet
= ($\frac{130}{120}$) hrs
= 1hr 5 min

Time they met = 10:15 a.m +
1:05
11:20 a.m

3. . a) ½ X 50h + ½ X 100 h + 150h = 2700
225h = 2700
H = $\frac{2700}{225}$ = 12m/s
Maximum speed = $\frac{12 \times 60 \times 60}{1000}$
= 43.2km/h
b) Acceleration = $\frac{12}{50}$ m/s
= $\frac{6}{25}$ m/s
c) ½ X 50 x 6
150 m
d) Time for half of journey
½ X 12 (50 + t + t) = ½ X 2700

6(50 + 2t) = ½ X 2700
50 + 2t = 225
T = $\frac{225 - 50}{2}$ = 87.5



Total time

= 50 + 87.5 = 137.5 sec

4. *Time taken at 10km*

= $^{45}/_{10}$ = 4.5 hrs

Time taken at 15km/hr

$^{45}/_{15}$ = 3hrs

Total time taken = (4.5 + 3) = 7.5

(4.5 + 3) = 7.5 hrs

Average speed

= $^{90}/_{7.5}$

= 12km/hr

5. $D = \frac{5}{4} \times 80 + \frac{50}{1000}$

= 100.05km

Speed = 120 – 80 = 40km/h

$T = \frac{D}{S} = \frac{100.05}{40}$

= 2.50125hours

(b) $D = S \times T = 120 + \frac{100.05}{4000} + \frac{199}{800}$

$= \frac{120 \times 11000}{40000}$

= 330km

(c) Total time = $\frac{330}{80}$

= $4^{1}/_{8}$hrs

Time lapse = $4\frac{1}{8} - \frac{5}{4} + \frac{100.05}{40000} + \frac{199}{800}$

$= 4\frac{1}{8} - 4$

= $^{1}/_{8}$hrs

6. *a) Distance traveled by bus before the matatu started off the journey is*

Distance = speed x time

= 60 x 2 ½

= 150km

Relative speed = 100- 60 = 40km/hr

The matatu would cover the bus head start of 150km in 150/40 hrs = 3.75hrs = 3hrs 45 min

∴ The matatu will overtake the bus after 3hrs 45 minutes

This will be 1:15 + 3:45 = 5.00pm

b) Time taken by the matatu to complete the remaining 350km = 350/100 = 3 ½ hrs

= 3hours 30 minutes

Time taken by the bus to complete the remaining 350

= $^{350}/_{60}$ = $5^{5}/_{6}$ hrs = 5 hours 50 minutes

Matatu waits for 5hr 50min – 3hr 30 min = 2 hrs 20 min

7. *Total distance = 100 + 140 + 150 = 490*
Total speed = 88 + 164 = 252 km/hr
252 km/hr into m/h = $\frac{252 \times 1000}{3600}$ = 70m/h

Time taken = $^{490}/_{70}$ = 7 sec

8. *Distance = (5 + 15)m = 20m = 0.02km*
S ⇒ Bus = 40 km/h
Trailer = xkm/h
Relative speed = (40 – x) km/h
T = 4.8 sec. = $\frac{4.8h}{3600}$

$$S = \frac{D}{T}$$

$$(40 - x) = \frac{0.02}{\frac{48}{3600}}$$

$$\simeq \frac{0.02 \times 3600}{48}$$

= 15 km/h
40 – x = 15
x = 25 km/h

9. *L.C.M = $2^4 \times 3^2 \times 5^3 = 1800$*

GC.D. = $2 \times 3 \times 5^2 = 150$

10. *Total distance = 60 cm*
Total time taken = $3\ ^1/_5$ hrs
Let speed in still water be x km/h
Speed upstream = (x – 5) km/h
Speed downstream = (x + 5) km/h

$$\frac{30}{x - 5} + \frac{30}{x + 5} = \frac{16}{5}$$

$$30x - 150 + 30x + 150 = \frac{16}{5}(x^2 - 25)$$

$$300x = 16x^2 - 400$$

x= $-^5/_4$ or 20

∴ Speed in still water is 20 km/hr

11. *When David left, Ojwang had covered $15 \times {}^3/_2$ = 22.5 km.*
a) (i) Remaining dist. = 40 – 22.5 = 17.5 km
Relative speed = 15 + 25 = 40 km/h
Time taken before meeting = $\frac{17.5}{40}$ = 0.4375 hrs
Ojwang covered 15 x 0.437 = 5.5625 km

Distance from Ojwang's house = 22.5 + 6.5625 ✓
= 29.0625 km

(ii) 0.4375 = 26 min 15 sec
∴ They met at 10.30 + 26.15
= 10.56. 15 am.

(iii) 40 – 29.0625 ✓ = 10.9375 km ✓

b) Time take = $\frac{10.9375}{12}$ ✓ = 0.9115 hrs
= 54 min, 41 sec.
They arrived at 10.56. 15 + 54.41 + 10 min
= 12.00. 56 pm. ✓

12. *(a)* In 10minutes Kamau has travelled
$\frac{10}{60}$ x 24 = 6km
Distance left = 42 – 6 = 36km
Relating speed = 24 + 50.4k/hr
= 74.4km/hr
Time taken to meet = $\frac{42}{74.4}$ = 0.565hrs
= 34minutes
Time for meeting is 6.10
34
6.44a.m
$\frac{34}{60}$ x 50.4 = 28.56km from R or 13.44 from S

(b) Kamau arrival time
42km / 24km/hr = 1.75hrs
1hr .45 minutes

6.00a.m
1.45
7.45a.m

(c) Mrs Ronoh speed = $\frac{D}{T}$
= 50.4km/hr
Twice = 50.4 x 2 = 100.8
7.00a.m, Mr. Kamau covered = 1x24= 24km
Retain speed = 100.8- 24 = 76.8km/hr
So 24 = 8.75
76.8
He was overtaken at 7.00
+ 18.75
7.18am

At distance of D = S x t

$$= \frac{100.8 \times 189.75}{60}$$

31.5km from S or 10.5km from R

13. *i) A gains on B at the rate of (72 – 56) Km/hr or 16km/h*

∴ in 1 hr A gains on B 16km

In 545 A gains on B

$$\frac{16 \times 1000 \times 54\ m}{60 \times 60} = 240$$

The sum of the lengths of the two trains is 240m but the length of the first train is 100m

The length of the second train is 140m

ii) Relative speed = (72 + 56) km/h = 128km/hr

Distance between A and B decrease at the rate of 128km/hr

The distance decreases by 240m

$$\frac{60 \times 60 \times 240}{128 \times 1000}\ s = \frac{27}{4}\ \text{seconds}$$

$$= 6\ ¾\ s$$

14. *(a) Time* $= \frac{D}{S}$

$$= \frac{5}{x}\ hrs$$

(ii) Time $= \frac{7}{x + 24}\ hrs$

(b) $\frac{5}{x} - \frac{36}{60} = \frac{7}{x + 24}$

$$\frac{7}{x + 24} = \frac{25 - 3x}{5x}$$

$$35x = 25x - 3x^2 + 600 - 72x$$

$$3x^2 + 82x - 600 = 0$$

$$(3x + 100)(x - 6) = 0$$

$$x = \frac{-100}{3} \text{ or } 6$$

His speed = 6km/hr

(c) Time = S x T

$$= \frac{5}{6} \times 60$$

$$= 50mins$$

15. *a) Relative speed = 80 - 60*

= 20 km/h

$$Time = \frac{40}{20}\ hrs$$

$$= 2\ hrs$$

(b) 1.50 p.m. = 13.50 hrs.

Time = 13.50 + 2 = 15.50 hrs

16. (a) Nairobi 400km Kisumu

Speed = 120km/h

Distance = 400km

Time taken = $\frac{400}{120} = 10 = 3\text{hrs } 20\text{min}$

8.30 + 3hrs 20min = 11:50a.m

(b) at 8.30a.m distance covered by bus = ½ x 80 = 40km

Dist. Left = 360km speed = 200km/h

Time taken = $\frac{360}{200} = 1\text{hr } 48\text{mins}$

They met at 8:30+ 1hr 48mins

= 10:18a.m

(c) 8 – 10.18a.m is 2hrs 18mins distance = $2 \times 80 + \frac{18}{60} \times 80$

= 160 + 24km = 184 from Nairobi

(d) car arrived in Nairobi after 3hrs 20mins

Bus traveled a time of 3hrs 20mins + 30mins

3hrs 50mins

Dist. = $3 \times 80 + \frac{50}{60} \times 80 = 240 + 66\ ^{2}/_{3}$

Distance from Kisumu = $93\ ^{1}/_{3}$ km

17. Total distance = 25m

Relative speed= 54km/hr

To m/s = $\left(\frac{54 \times 1000}{60 \times 60}\right) = 15/ms$

Time they met = $\left(\frac{25}{15}\right)$

= $1\ ^{2}/_{3}$ sec