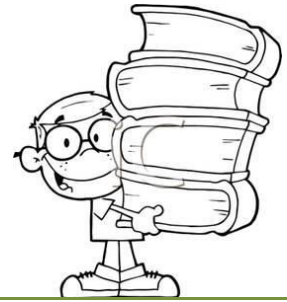


TIME, SPEED AND DISTANCE



DRILL 1: SOLUTIONS

a. Explanation:

Speed = 180 km/hr

Distance covered by you in

i. 2 hrs $\rightarrow d = s \cdot t = 180 \cdot 2 = \mathbf{360 \text{ Km}}$

ii. 5 hrs $\rightarrow 180 \cdot 5 = \mathbf{900 \text{ Km}}$

iii. 35 min $\rightarrow 180 \cdot (35/60) = \mathbf{105 \text{ Km}}$

b. Answer : 16 sec

Explanation:

Speed = 180 km/hr

540 km $\rightarrow t = d/s = 540/180 = \mathbf{3 \text{ hrs}}$

60 km $\rightarrow 60/180 = \mathbf{20 \text{ minutes}}$

15 km $\rightarrow 15/180 = \mathbf{5 \text{ minutes}}$

800 m $\Rightarrow t = d/s \Rightarrow S = 180 \text{ km/hr}$
 $= 180 \cdot (5/18)$
 $= 50 \text{ m/sec,}$
 $T = 800/50 = \mathbf{16 \text{ sec}}$

c. Answer : 40 mins

Explanation:

$d = s \cdot t$

If the distance is same and the speed is reduced to half of its original, the time will be twice of the original, because $S \propto (1/t)$ [d is constant]

When Speed becomes $5/7$, then time has to become $7/5$ in order to have same distance. Hence $7/5$ can be written as $(5/5 + 2/5)$ where $2/5$ is the excess time which is equal to 16 minutes.

$2/5 t = 16$

$T = \mathbf{40 \text{ minutes}}$

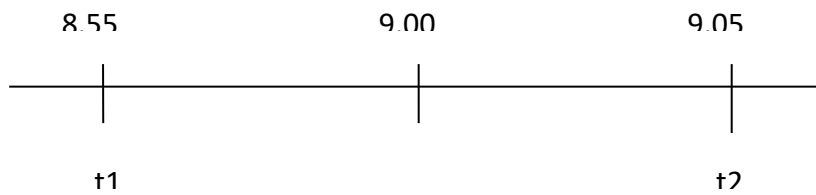
d. Answer : 10 km

Explanation:

Speed of 20 km /hr $\Rightarrow 5 \text{ mins late to the office.}$

Speed of 30 km/hr $\Rightarrow 5 \text{ mins early to the office.}$

So, if the office time is 9.00 o' clock



$$t_1 - t_2 = 10 \text{ min}$$

$$(d/s_1) - (d/s_2) = 10/60$$

$$(d/20) - (d/30) = 1/6$$

$$d/60 = 1/6$$

$$d = 10 \text{ km}$$

e. Answer: 38.88 km/hr

Explanation:

$$\begin{aligned} \text{Total distance covered} &= 210 \text{ km} + 140 \text{ km} \\ &= 350 \text{ km} \end{aligned}$$

$$\begin{aligned} \text{Time taken for first 210 km} &= d/s \\ &= 210/30 \\ &= 7 \text{ hrs} \end{aligned}$$

$$\begin{aligned} \text{Time taken for next 140 km} &= 140/70 \\ &= 2 \text{ hrs} \end{aligned}$$

$$\text{Total time taken} = 7 + 2 = 9 \text{ hrs}$$

$$\begin{aligned} \text{Average speed} &= \text{Total distance} / \text{Total time} \\ &= 350/9 \\ &= 38.88 \text{ km/hr} \end{aligned}$$

f. Answer: 42 km/hr

Explanation:

Yes, the two distances to be covered are same.

Total distance covered is the double of LCM of the two speeds

$$\text{LCM}(70, 30) = 210$$

$$\begin{aligned} \text{Distance} &= 210 + 210 \\ &= 420 \text{ km} \end{aligned}$$

Total time taken,

$$T_1 = 210/70 = 3 \text{ hrs}$$

$$T_2 = 210/30 = 7 \text{ hrs}$$

$$\text{Total time taken} = 7 + 3 = 10 \text{ hrs}$$

$$\text{Average speed} = \text{total distance} / \text{total time}$$

$$= (420)/(10)$$

$$= 42 \text{ km/hr}$$

DRILL 2: SOLUTIONS

Explanation:

Case 1:

Average speed = 40 km/hr
 Distance to be covered = 120 km
 Time taken = distance/speed
 $= 120/40 = 3 \text{ hrs}$

This is the concept 1 which we had discussed earlier. The next two questions are based on the relative speed concept. Be careful with the directions.

Case 2:

Your speed = 40 km/hr
 Friends speed = 20 km/hr
 Both travelling towards each other so, it is **opposite direction**.

$$T = d/s$$

Opposite direction $\rightarrow S_1 + S_2$

$$T = 120 / (40 + 20)$$

$$= 120/60 = 2 \text{ hrs}$$

It would take you 2 hours to meet your friend.

Case 3:

Same speed of you and your friend, but here the **direction is same**.

Distance between you and your friend after an hour will be?

After 1 hour,

Distance covered by you	= 40 km	= (0+40) km
Distance covered by your friend	= 20 km	= (120+20) km
Distance between you and your friend		= 100 km

$$T = d/s$$

Same direction $\rightarrow S_1 - S_2$

$$T = 120 / (40 - 20)$$

$$= 120/20$$

$$= 6 \text{ hrs}$$

It would take you 6 hours to meet your friend.

DRILL 3: SOLUTIONS

a. Answer: 72 sec

Explanation:

Total distance = length of the train + length of the bridge
= 90 m + 270 m
= 360 m

Speed of the train = 18 Km/hr
= $18 \times (5/18)$ m/sec [Converting to m/sec]

Time taken to cross bridge = total distances covered / speed of the train
= 360 / 5
= 72 sec

b. Answer: 7.2 sec

Explanation:

Length of the train = 90 m

Speed of the train (S_1) = 40 Km/hr

Speed of Man (S_2) = 5 Km/hr

Total distance = 90 m

Relative speed = $S_1 + S_2$ [They are travelling in opposite direction]
= 40 + 5 = 45 Km/hr

= $45 \times (5/18)$ = 25/2 [Converting to m/sec]

Time taken = total distance / speed
= $(90/52) \times 2$
= 3.6×2 = 7.2 sec

DRILL 4: SOLUTIONS

a. Answer: 4 hrs

Explanation:

Speed of boat S_B = 13 km/hr

Speed of stream S_S = 4 km/hr

Downstream:

Effective speed, S_E = $S_B - S_S$
= 13 + 4 = 17 km/hr

Time taken = Distance / Effective speed
= 68 km / 17 km/hr
= 4 hrs

b. Answer: 1.5 Km/hr

Explanation:

Downstream speed = $40/5 = 8$ km/hr

Upstream speed = $30/6 = 5$ km/hr

Therefore $S_B + S_S = 8$ km/hr

$S_B - S_S = 5$ km/hr

Hence $S_B = 6.5$ km/hr [Note: Speed of boat \rightarrow Avg of downstream & upstream]

$S_S = 1.5$ Km/hr

DRILL 5: SOLUTIONS

a. Answer: 80 m

Explanation:

Ratio of time taken = $36:45 = 4:5$

Ratio of speed covered = $5:4 = 100 \text{ m} : x$

B covers = $(100/5) \times 4 = 80 \text{ m}$

b. Answer: 28 m

Explanation:

A beats B by = $100 - 80 = 20 \text{ m}$

A	B	C
100m	75m	
	100m	96m

For 100m B runs, C runs 4m less \Rightarrow

Therefore for 25m = 1m less
75m = 3m less = 72m

A	B	C
100m	75m	72m

When A covers 100m, **C=72m**

Therefore A beats C by = $100 - 72 = 28 \text{ m}$

c. Answer: 3.14 hrs

Explanation:

Distance in circular track = Circumference of track
 $= 2\pi r$

Diameter = 4km

Radius = 2km

Distance covered = $2\pi r$

$= 4\pi$

Relative speed = $(3+1)$

$= 4 \text{ km/hr}$

Time taken =distance / speed
 = $4\pi / 4$
 = π or **3.14 hrs**

GOOGLY QUESTIONS

1. **Wrong**

Average speed= $2xy / (x+y)$ not $(x+y) / 2$

The speed for both the distances is different because of which the time taken for reaching the same distance will be different. Avg. Speed= $(2*40*60) / (60+40) = 4800 / 100 = 48 \text{ Km/hr}$

2. **Wrong**

Average speed= Total distance/ Total time [since the distance is varying, we cannot use $2xy/(x+y)$]

3. **Wrong**

The direction is not mentioned in the question.

Hence the answer cannot be determined.

4. **Correct**

5. **Wrong**

A	B
200m	175m
200m	155m

So to cover, 20m=10s for B
1m=1/2 s

S=40:31

T=31:40 [$S \propto (1/T)$]

'B' would take 100s and hence 'A' would take 77.5 s to cover 200m.

CONCEPT REVIEW QUESTIONS

1. *Answer:* **15Km/hr**

Explanation:

Speed=Distance / time

For this question move from options.

(b) 8 Km/hr

We know that the speed of Ram is less and the difference in speeds is 5 km/hr

$$S = d/t \text{ speed of Ram} = 8 \text{ Km/hr}$$

$$\text{Time} = 180/8 = 22.5 \text{ hrs.}$$

Now we know Karthick takes 3 hrs less

$$= 22.5 - 3 = 19.5 \text{ hrs.}$$

$$\text{Speed of Karthick} = 180/19.5 = 9.23 \text{ km/hr.}$$

Here the difference is not 5 hrs so this case of speed 8km/hr can be eliminated.

(c) 15Km/hr

Now let's take c) 15Km/hr,

$$\text{Speed of Ram} = 15 \text{ Km/hr}$$

$$\begin{aligned} \text{Speed} &= \text{distance/time} \\ &= 180/15 = 12 \text{ hrs.} \end{aligned}$$

Now we know that Ram takes 3 more hours than Karthick.

$$\text{Time taken by Karthick} = (12-3) = 9 \text{ hrs.}$$

We can find the speed of Karthick to check the answer.

$$S = D/T = 180/9 = \mathbf{20 \text{ Km/hr}}$$

Now given that Karthick drives his car 5Km/hr faster than Ram,

$$\text{So } (20-15) = 5 \text{ Km/hr}$$

Speed of karthick speed of Ram

In this case the speed of **15Km/hr** is verified.

2. **Answer: 20sec.**

Explanation:

2 identical trains = equal number of bogies

Train A = 12 bogies

Train b = 12 bogies

Time duration to cross = 2 min or 120sec

Total no: of bogies = 24 bogies

24 bogies cross each other at 120 sec

$$\text{So, for 1 bogie} = 120/24$$

$$= 5 \text{ seconds}$$

$$\text{Bogie A increased by 4 bogies} = 12 + 4 = 16$$

$$1 \text{ bogie} = 5 \text{ sec}$$

$$\text{So for 4 bogies} = 4 * 5$$

$$= 20 \text{ sec}$$

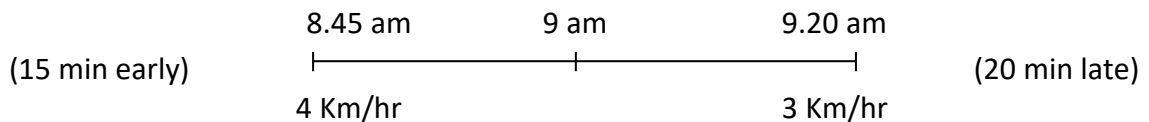
3. **Answer: 7km**

Explanation:

Speed of 3Km/hr \Rightarrow 20 min late

Speed of 4km/hr \Rightarrow 15 min early

So let's assume I have to reach my office at 9 a.m



Total time difference = 35 min

$$(S = D/T)$$

Here 'd' is the distance

$$(d/3) - (d/4) = 35/60$$

$$(4d - 3d)/12 = 35/60$$

$$D = 7 \text{ km}$$

Distance between house and office = **7km.**

4. **Answer: 2 km/hr**

Explanation:

Speed in still water = u

Speed in current = v

Given:

$$u + v = 2(u - v)$$

$$u = 3v$$

So let the ratio be 1:3

Speed of man in still water = 6 km/hr

We know $u = 3v \Rightarrow 1:3$

So, rate of current in stream = 6 / 3

$$\Rightarrow v = 2 \text{ km/hr}$$

5. **Answer: 15 km**

Explanation:

Speed of Prem = 10 Km/hr

Speed of Shyam = 15 Km/hr

Let distance travelled = 'd'

$$S = D / T$$

$$T = D/S$$

$$\begin{aligned}
 (D/10) - (D/15) &= 30/60 \\
 (3D-2D)/30 &= 30/60 \\
 D &= 30/2 \\
 \Rightarrow D &= 15 \text{ km}
 \end{aligned}$$

6. **Answer: 20 min**

Explanation:

$$S = D/T$$

Here we know the speed has decreased to, $4/7 * S$

So time would be increased to $(7/4 * T)$ in order to make the distance constant

$$D = 4/7 S * (7/4 T)$$



$$[(4/4)T + (3/4)T]$$

$(3/4)T$ \Rightarrow extra time taken to cover the distance

$$(\frac{3}{4})T = 15 \text{ min}$$

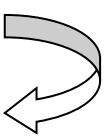
$$\Rightarrow T = (15 * 4) / 3$$

Time = 20 min

The time Ram takes walking at the usual speed = 20 min

7. **Answer: 77.5 sec**

Explanation:

	A	:	B	
	200m	:	175m	
T	A	:	B	
S	200m	:	155m	
175-155	= 20 m			 10sec
				[this is covered in 10 sec]

B covers 20m in 10s

$$\begin{aligned}
 \text{For 155m time} &= 155 * (10/20) \\
 &= 77.5 \text{ sec}
 \end{aligned}$$

Time taken by A to finish the race = **77.5 sec**

8. **Answer: 10 seconds**

Explanation:

$$\text{Total speed} = 72 + 36 = 108 \text{ km/hr}$$

[Converting to m/sec]

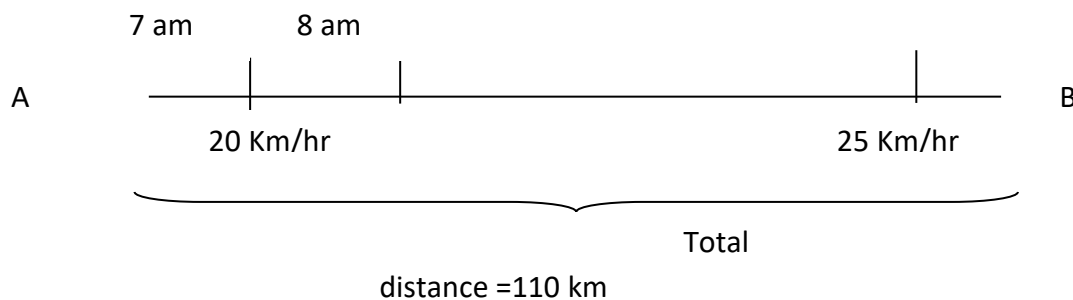
Distance covered=300 m

Time taken = S = D/T

Therefore time taken=**10 seconds**

9. *Answer: 10 a.m.*

Explanation:



According to the question one train starts travelling at 20Km/hr, so for one hour it would have travelled 20 km.

Now relative speed \rightarrow (opposite direction)

Speed = 20 + 25 km/hr
= 45 Km/hr

The distance = 90 km

Speed = 45 Km/hr

So time taken to cover 90 km

$$S = D/T$$
$$T = D/S$$
$$= 90/45$$

Therefore time taken = **2 hrs**

The time taken by the train to meet starting from 8 am = $8 + 2 = 10$ am

The train moved have met at **10 am.**

10. *Answer:* **198 m**

Explanation:

Total distance travelled by train = length of train (L)

Total time taken = 9 sec = $L/s \rightarrow (1)$

When the train crosses the platform of 99m,

Distance covered = L+99

Total time taken to cross the platform

$$13.5 = (L+99)/S \rightarrow (2)$$

Sub 1 in 2

$$13.5 = (L+99)/(L/9)$$

$$13.5 = (9L+891)/L$$

$$13.5L = 9L+891$$

$$4.5L = 891$$

$$L = 198 \text{ m}$$

Length of train = **198 m**

11. **Answer: 1/4 km**

Explanation:

Relative speed of two boats, since they are in opposite directions,

$$10\text{Km/hr}+5\text{Km/hr} = 15\text{Km/hr}$$



Relative distance travelled in 1 hr = 15 km

Distance between them before 1 hr of collision = 15 km

Distance between them before 1 min of collision = $15/60$
 = **1/4 km**

12. **Answer: 7 times**

Explanation:

A completes 2 rounds per hour } opposite
 B completes 3 rounds per hour } direction

As they are travelling in opposite direction

They will meet 5 times in 1 hr

From 10 am to 11.30 am -----1 ½ hrs

1 hr-----5 times

½ hr-----2.5 times (.5 neglected as they cannot meet .5 times)

Therefore 5 +2=**7 times**

13. **Answer: 80 sec**

Explanation:

From the question, when Ani completes the race, Bini will be 22.5 m behind.

Bini travels 22.5 m in 6 sec.

$$\text{Time taken to cover 300m} = \frac{6}{22.5} \times 300 = 80$$

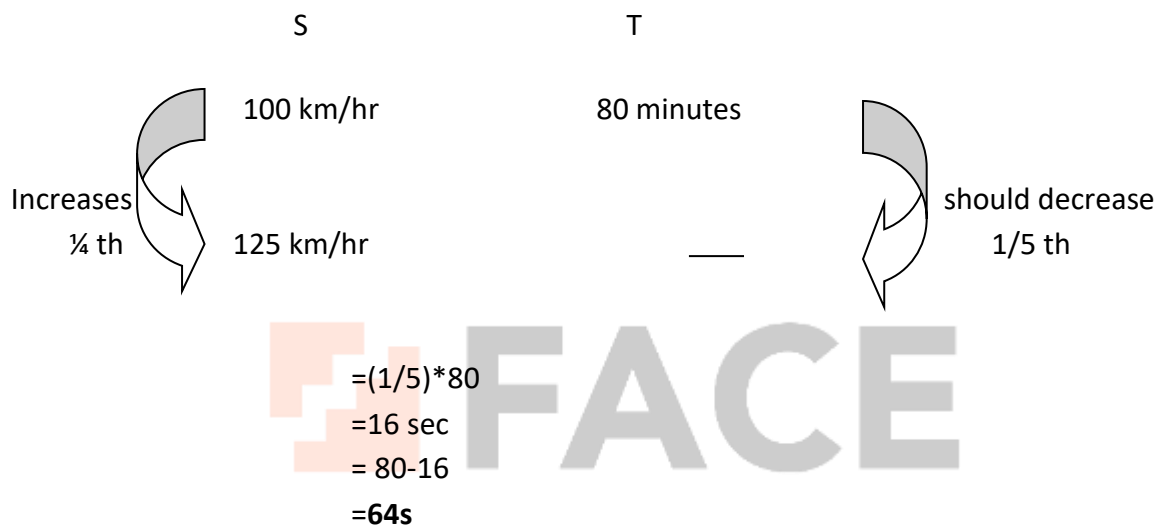
[22.5 = 7.5+7.5+7.5]; [6sec as (2 + 2+ 2)] [This calculation can also be simplified as below]

To cover 15 m, Bini will take 4 sec.

$$\begin{array}{l} 15 \text{ m} \rightarrow 4 \text{ sec} \\ * 20 \\ \hline 300 \text{ m} \rightarrow 4 * 20 = \mathbf{80 \text{ sec}} \end{array}$$

14. **Answer: 64s**

Explanation:



This is because; as distance is constant speed is inversely proportional to time

$$S \propto \frac{1}{T}$$

Therefore when speed increases by $\frac{1}{n}$

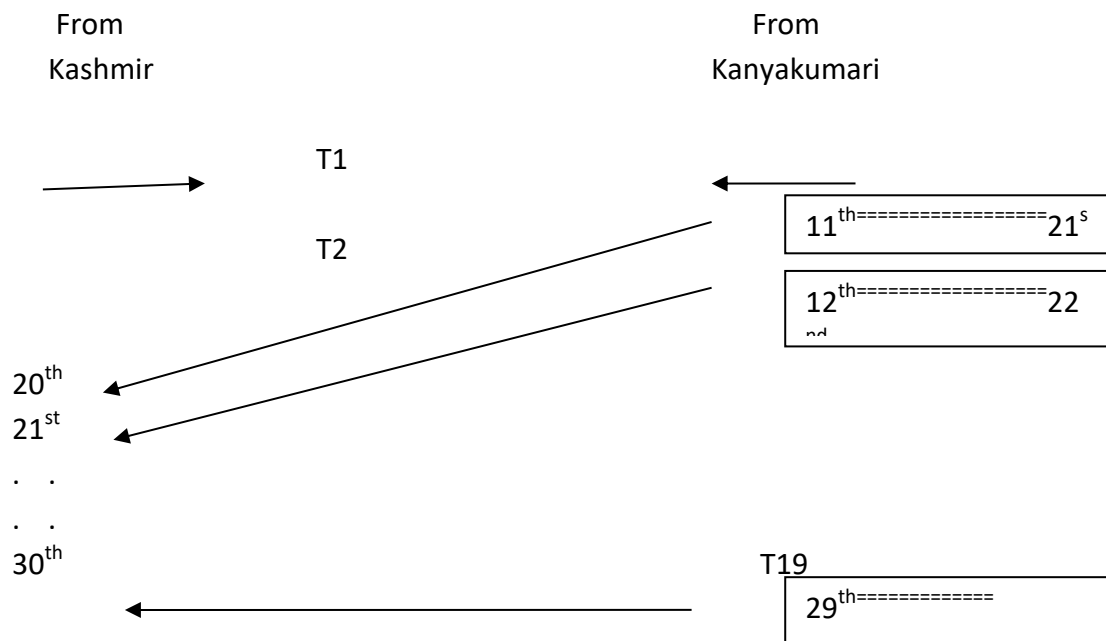
Time decreases by $\frac{1}{(n+1)}$.

15. **Answer: 19 trains**

Explanation:

A train requires 10 days of journey to reach the destination
20th April, 11 AM, you are starting from Kashmir so you can see all the trains which started from Kanyakumari from 11th to 29th

You can see all the trains that would 10th because it has already completed the journey on 20th at your starting time.



We cannot see the train starting on 30th because we are completing our journey on the same day. Hence we can see **19 trains**.

