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QUANTITATIVE APTITUDE · FREE STUDY MATERIAL

Problems on Trains

Formulas & Shortcut Tricks

Every important formula, shortcut and exam trick for Problems on Trains in one place – with solved examples, common mistakes and a one-page revision sheet.

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USEFUL FOR

- Railways (RRB NTPC, Group D)
- SSC CGL / CHSL / MTS
- Bank PO & Clerk (IBPS, SBI, RBI)
- Campus placements (TCS, Infosys, Wipro, Accenture)
- UPSC CSAT & state PSC exams

Practise **Problems on Trains** free on LearnFrenzy – questions with instant explanations →

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1 Topic introduction

What it is, why it matters and how it is asked

Train problems are speed–time–distance problems with one twist: a train has length. To pass a pole or a standing man, the train must move its own length; to pass a platform, bridge or another train, it must move its own length plus the length of that object.

Add relative speed – the sum for trains moving towards each other, the difference for trains going the same way – and you can solve almost every railway question in two lines. Always convert km/h to m/s when lengths are in metres and times in seconds.

Why it matters in exams

- Railway exams (RRB NTPC, Group D) and SSC papers ask train questions in almost every shift.
- Bank and placement tests use two-train and “two crossing times” problems.
- The ideas reinforce relative speed and unit conversion for the whole speed chapter.

Where it is used

- Reading timetables and working out crossing and arrival times.
- Safety calculations at level crossings and platforms.
- Any situation where a long object passes another object.

Common question patterns

Pole or man
Time to pass a point-sized object.

Platform, bridge, tunnel
Add the object’s length to the train’s.

Two trains
Opposite directions (add speeds) or same direction (subtract).

Moving people
Passing a man walking or cycling beside the track.

Two crossing times
Find the length and speed from a pole and a platform.

Man in a train
Another train passes a passenger sitting in a train.

Meeting times
Trains from two stations, one starting later.

$\surd$ rule and delays
Speeds from times after crossing; accidents and halts.

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2 Important formulas

Cards marked MOST USED are the ones to revise first

Passing an object

Pole, signal post or standing man

MOST USED

Time = length of train ÷ speed of train

A pole has no length, so only the train's length is covered.

EXAMPLE 240 m train at 72 km/h (20 m/s) passes a pole in 240 ÷ 20 = **12 s**.

Platform, bridge or tunnel

MOST USED

Time = (length of train + length of object) ÷ speed of train

The train has fully crossed only when its last coach leaves the far end.

EXAMPLE 180 m train at 54 km/h (15 m/s) crosses a 270 m platform in 450 ÷ 15 = **30 s**.

Two trains

Opposite directions

MOST USED

Time to cross = $(L_1 + L_2)/(S_1 + S_2)$

They approach each other at the sum of their speeds.

EXAMPLE 150 m and 250 m trains at 50 and 40 km/h → 400 m ÷ 25 m/s = **16 s**.

Same direction (overtaking)

MOST USED

Time to overtake = $(L_1 + L_2)/(S_1 - S_2)$

The faster train gains only the difference in speeds.

EXAMPLE Same trains, same direction → 400 m ÷ (10 km/h = 25/9 m/s) = **144 s**.

A man sitting in a train

Time = length of the other train ÷ relative speed

The passenger is a point, so only the other train's length counts.

EXAMPLE A man in a train at 45 km/h sees a 270 m train coming the other way at 63 km/h → 270 ÷ 30 = **9 s**.

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Moving people and two crossing times

Passing a man who is walking

> **Time = length of train ÷ (train speed ± man's speed)**

Add the speeds if the man walks towards the train, subtract if he walks the same way.

EXAMPLE 200 m train at 64 km/h passes a man walking towards it at 8 km/h → 200 ÷ 20 = **10 s**.

Length and speed from two crossings

MOST USED

> **Speed = platform length / ($t_{platform} - t_{pole}$); train length = speed × t_{pole}**

The extra time is spent covering the platform alone.

EXAMPLE Pole in 15 s, 300 m platform in 35 s → speed = 300/20 = 15 m/s, length = 15 × 15 = **225 m**.

Meeting, √ rule and delays

Trains from two stations

MOST USED

> **Cover the head start first, then: time to meet = remaining distance / ($S_1 + S_2$)**

If one leaves later, move the clock to when both are moving.

EXAMPLE X → Y is 330 km. A leaves X at 7 am at 60 km/h; B leaves Y at 8 am at 75 km/h → at 8 am 270 km remain → meet at **10 am**.

Square-root rule after crossing

> **If after meeting the trains take t_1 and t_2 hours to reach their destinations: $S_1/S_2 = \sqrt{t_2}/\sqrt{t_1}$**

The train that takes longer afterwards is the slower one.

EXAMPLE Times after meeting 9 h and 16 h → $S_1 : S_2 = 4 : 3$ → ratio **4/3**.

Running at reduced speed

> **At (a/b) of the usual speed for the rest of the trip: delay = remaining usual time × (b – a)/a**

Slower running stretches the remaining time to b/a of normal.

EXAMPLE 3 h of normal running left, now at 3/4 speed → delay = 3 × 1/3 = **1 h**.

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3 Shortcut tricks & smart techniques

Each trick says when to use it – that matters as much as the trick

What length to add

MOST USED

USE WHEN Every train question – decide the distance first.

The train passes …	Distance covered
a pole, signal or standing man	its own length
a platform, bridge or tunnel	own length + that length
another train	sum of both lengths
a man walking or in another train	own length (or the other train's length for the man in it)

EXAMPLE 300 m train and 200 m bridge → distance **500 m**.

Two-crossing trick

MOST USED

USE WHEN A train passes a pole (or man) and a platform; length and speed are unknown.

1. Extra time = time for the platform − time for the pole.
2. Speed = platform length ÷ extra time.
3. Length = speed × pole time.

EXAMPLE Man in 12 s, 210 m platform in 26 s → speed 15 m/s → length **180 m**.

Crossing vs overtaking time ratio

USE WHEN The same two trains cross in opposite and in the same direction.

1. Distance is the same (sum of lengths).
2. Time ratio = $(S_1 - S_2) : (S_1 + S_2)$ for opposite : same.

EXAMPLE Speeds 54 and 36 km/h → opposite : same = 18 : 90 = **1 : 5**.

Speed from a man in another train

USE WHEN A passenger in one train times another train going past.

1. Relative speed = other train's length ÷ time.
2. Subtract (or add) the passenger's own train speed.

EXAMPLE Goods train 280 m passes a man in a 40 km/h train (opposite) in 9 s → relative 112 km/h → goods train **72 km/h**.

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4 Solved examples

The full method on the left, the exam shortcut on the right

1 POLE

A 360 m long train passes a signal post in 18 seconds. What is its speed in km/h?

STEP BY STEP

1. Speed = 360 ÷ 18 = 20 m/s.
2. 20 × 18/5 = 72 km/h.

SHORTCUT

m/s × 3.6 = km/h → 20 × 3.6 = 72.

Why it works: A signal post has no length, so only the train's length is covered.

Answer: 72 km/h

2 PLATFORM

A 240 m train running at 90 km/h crosses a 360 m platform. How long does it take?

STEP BY STEP

1. Distance = 240 + 360 = 600 m.
2. Speed = 90 × 5/18 = 25 m/s.
3. Time = 600 ÷ 25 = 24 s.

SHORTCUT

600 ÷ 25 = 24.

Why it works: The train must clear its own length and the platform's.

Answer: 24 seconds

3 BRIDGE

A 200 m train at 54 km/h crosses a bridge in 40 seconds. How long is the bridge?

STEP BY STEP

1. Speed = 15 m/s → distance in 40 s = 600 m.
2. Bridge = 600 − 200 = 400 m.

SHORTCUT

15 × 40 − 200 = 400.

Why it works: The distance covered includes the train's own length.

Answer: 400 m

4 OPPOSITE

Two trains 180 m and 220 m long run on parallel tracks towards each other at 60 km/h and 84 km/h. How long do they take to cross each other?

STEP BY STEP

1. Relative speed = 144 km/h = 40 m/s.
2. Distance = 400 m.
3. Time = 400 ÷ 40 = 10 s.

SHORTCUT

(180 + 220) ÷ (144 × 5/18) = 10.

Why it works: Moving towards each other, the speeds add.

Answer: 10 seconds

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5 SAME DIRECTION

A 120 m train at 72 km/h overtakes a 180 m train going the same way at 54 km/h. How long does the overtaking take?

STEP BY STEP

1. Relative speed = 18 km/h = 5 m/s.
2. Distance = 300 m.
3. Time = 300 ÷ 5 = 60 s.

SHORTCUT

300 ÷ 5 = 60.

Why it works: The faster train gains only 5 m every second.

Answer: 60 seconds

6 WALKING MAN

A 225 m train passes a man walking at 6 km/h in the same direction in 15 seconds. What is the train's speed?

STEP BY STEP

1. Relative speed = 225 ÷ 15 = 15 m/s = 54 km/h.
2. Train speed = 54 + 6 = 60 km/h.

SHORTCUT

Relative + man's speed (same direction) = train speed.

Why it works: The train only gains on the man at the difference of their speeds.

Answer: 60 km/h

7 TWO CROSSINGS

A train passes a man standing on a platform in 12 seconds and passes the 210 m platform itself in 26 seconds. How long is the train?

STEP BY STEP

1. Extra 14 s are for the 210 m platform → speed 15 m/s.
2. Length = 15 × 12 = 180 m.

SHORTCUT

210 ÷ 14 × 12 = 180.

Why it works: The difference in times is the time to cover the platform alone.

Answer: 180 m

8 MAN IN A TRAIN

A man in a train travelling at 40 km/h sees a 280 m goods train coming the other way pass him in 9 seconds. What is the speed of the goods train?

STEP BY STEP

1. Relative speed = 280 ÷ 9 m/s = 112 km/h.
2. Goods train = 112 − 40 = 72 km/h.

SHORTCUT

280/9 × 18/5 − 40 = 72.

Why it works: Only the goods train's length passes the man.

Answer: 72 km/h

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9 √ RULE

Two trains start at the same time from stations A and B towards each other. After meeting, they take 4 hours and 9 hours to reach B and A respectively. Find the ratio of their speeds.

STEP BY STEP

1. $S_A / S_B = \sqrt{(\text{time of B})} / \sqrt{(\text{time of A})}$.
2. $= \sqrt{9} / \sqrt{4} = 3/2$.

SHORTCUT

$\sqrt{9} : \sqrt{4} = 3 : 2$.

Why it works: The faster train needs less time after the meeting.

Answer: 3 : 2

10 LATE START

Stations X and Y are 330 km apart. A train leaves X at 7 am at 60 km/h towards Y; another leaves Y at 8 am at 75 km/h towards X. When do they meet?

STEP BY STEP

1. By 8 am the first train has gone 60 km → 270 km apart.
2. Closing speed = 135 km/h → 2 hours.
3. They meet at 10 am.

SHORTCUT

8 am + 270 ÷ 135 h = 10 am.

Why it works: Start the joint clock only when both trains are moving.

Answer: 10:00 am

11 RATIO OF TIMES

Two 150 m trains run at 54 km/h and 36 km/h. How long do they take to pass each other when moving in opposite directions, and in the same direction?

STEP BY STEP

1. Distance = 300 m in both cases.
2. Opposite: 90 km/h = 25 m/s → 12 s.
3. Same: 18 km/h = 5 m/s → 60 s.

SHORTCUT

Time ratio = 18 : 90 = 1 : 5 → 12 s and 60 s.

Why it works: The distance is fixed; only the relative speed changes.

Answer: 12 s and 60 s

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5 Important exam tips

Patterns, traps and habits that save marks

Frequently asked question patterns

- Passing a pole, a man or a platform.
- Finding the length of a bridge or platform.
- Two trains crossing in opposite and same directions.
- A train passing a walking man.
- Length and speed from two crossing times.
- A man sitting in another train.
- Late starts, the $\sqrt{}$ rule and reduced speed.

Common mistakes to avoid

- Forgetting to add the platform or bridge length.
- Leaving speeds in km/h while lengths are in metres.
- Adding speeds for trains going the same way.
- Adding the passenger's train length when only the other train passes him.
- Ignoring the head start when one train starts later.
- Converting 5/18 the wrong way round.

Points to remember

- Pole / man: distance = train length.
- Platform / bridge: train + object length.
- Opposite: add speeds; same: subtract.
- 72 km/h = 20 m/s; 54 km/h = 15 m/s; 90 km/h = 25 m/s.
- Two crossings: speed = platform ÷ time difference.

Speed and accuracy

- Learn the km/h–m/s table.
- Write the distance (which lengths?) before anything else.
- Work in m/s and convert only the final answer.
- Check by recomputing time = distance ÷ speed.

Preparation strategy

- Master the "what length to add" table and relative speed first.
- Practise on LearnFrenzy in order: Easy → Medium → Hard → Exam Pattern Mix → Diagram-Based → Data Sufficiency.
- Aim for 30–45 seconds per train question.
- Keep an error log of missing-length and unit mistakes.
- Read the Quick Revision Sheet (next page) the night before the exam.

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6 Quick revision sheet

Everything on one page for the night before the exam

Formulas

Pole / man	L/S	Platform / bridge	$(L + P)/S$
Opposite trains	$(L_1 + L_2)/(S_1 + S_2)$	Same direction	$(L_1 + L_2)/(S_1 - S_2)$
Walking man	$L/(S \pm s)$	Man in a train	L_{other}/relative speed
Two crossings	$S = P/(t_2 - t_1)$	Train length	$S \times t_{pole}$
km/h → m/s	$\times 5/18$	m/s → km/h	$\times 18/5$
Late start	gap first, then $\div (S_1 + S_2)$	$\sqrt{}$ rule	$S_1 : S_2 = \sqrt{t_2} : \sqrt{t_1}$
Reduced to a/b speed	$\text{delay} = T(b - a)/a$	Opp. : same time	$(S_1 - S_2) : (S_1 + S_2)$

Shortcut tricks

- Decide the distance first.
- Opposite add, same subtract.
- Pole + platform → two-time trick.
- Man in train: other length only.
- m/s throughout, km/h at the end.
- Late start: cover the gap first.

Must-know numbers

km/h → m/s	36 → 10 · 54 → 15 · 72 → 20 · 90 → 25 · 108 → 30 · 126 → 35 · 144 → 40
m/s → km/h	5 → 18 · 10 → 36 · 12.5 → 45 · 15 → 54 · 20 → 72 · 25 → 90

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7 A message from LearnFrenzy

For everyone preparing for placements, competitive and government exams

Keep going – you are closer than you think

Success in examinations is not just about how many hours you study. It is about how effectively you understand concepts, practise questions, and improve yourself every day.

Every formula you learn, every problem you solve, and every mistake you correct brings you one step closer to your goal.

Whether you are preparing for campus placements, competitive examinations, or government jobs, remember that consistency, confidence, and smart preparation make a real difference.

Don’t just memorize formulas. Understand the concepts, practise smart techniques, and develop the confidence to solve problems independently.

Your hard work today can create the opportunities you dream of tomorrow.

— Team LearnFrenzy

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