## CSAT PAPER

## ARITHMETIC APTITUDE TEST

## Trains:

Important formulas :

1. $\mathrm{km} / \mathrm{hr}$ to $\mathrm{m} / \mathrm{s}$ conversion:
$a \mathrm{~km} / \mathrm{hr}=\left(\int a \times \frac{5}{18}\right) \mathrm{m} / \mathrm{s}$.
2. $\mathrm{m} / \mathrm{s}$ to $\mathrm{km} / \mathrm{hr}$ conversion:
$a \mathrm{~m} / \mathrm{s}=\left(\int a \times \frac{18}{5}\right) \mathrm{km} / \mathrm{hr}$.
3. Formulas for finding Speed, Time and Distance
4. Time taken by a train of length / metres to pass a pole or standing man or a signal post is equal to the time taken by the train to cover / metres.
5. Time taken by a train of length / metres to pass a stationery object of length bmetres is the time taken by the train to cover $(I+b)$ metres.
6. Suppose two trains or two objects bodies are moving in the same direction at $u \mathrm{~m} / \mathrm{s}$ and $v \mathrm{~m} / \mathrm{s}$, where $u>v$, then their relative speed is $=$ $(u-v) \mathrm{m} / \mathrm{s}$.
7. Suppose two trains or two objects bodies are moving in opposite directions at $u \mathrm{~m} / \mathrm{s}$ and $v \mathrm{~m} / \mathrm{s}$, then their relative speed is $=(u+v) \mathrm{m} / \mathrm{s}$.
8. If two trains of length $a$ metres and $b$ metres are moving in opposite directions at $u \mathrm{~m} / \mathrm{s}$ and $v \mathrm{~m} / \mathrm{s}$, then:

The time taken by the trains to cross each other $=\frac{(a+b)}{(u+v)}$ sec.
9. If two trains of length $a$ metres and $b$ metres are moving in the same direction at $u \mathrm{~m} / \mathrm{s}$ and $v \mathrm{~m} / \mathrm{s}$, then:

The time taken by the faster train to cross the slower train $=\frac{(a+b)}{(u-v)}$ sec.
10. If two trains (or bodies) start at the same time from points $A$ and $B$ towards each other and after crossing they take $a$ and $b$ sec in reaching $B$ and $A$ respectively, then:
(A's speed) : (B's speed) $=(b: a)$

1. A train running at the speed of $60 \mathrm{~km} / \mathrm{hr}$ crosses a pole in 9 seconds. What is the length of the train?
A. 120 metres
B. 180 metres
C. 324 metres
D. 150 metres

Answer \& Explanation
Answer: Option D

## Explanation:

Speed $=\left(660 \times \frac{5}{18}\right)_{\mathrm{m} / \mathrm{sec}}=\left(\sqrt{\frac{50}{3}}\right)_{\mathrm{m} / \mathrm{sec}}$.
Length of the train $=($ Speed $x$ Time $)=\left(\sqrt{\frac{50}{3}} \times 9\right)_{m=150 m}$.
2. A train 125 m long passes a man, running at $5 \mathrm{~km} / \mathrm{hr}$ in the same direction in which the train is going, in 10 seconds. The speed of the train is:
A. $45 \mathrm{~km} / \mathrm{hr}$
B. $50 \mathrm{~km} / \mathrm{hr}$
C. $\quad 54 \mathrm{~km} / \mathrm{hr}$
D. $55 \mathrm{~km} / \mathrm{hr}$

Answer \& Explanation
Answer: Option B

## Explanation:

Speed of the train relative to $\operatorname{man}=\left(\frac{1125}{10}\right) \mathrm{m} / \mathrm{sec}$
$=(\sqrt{25})_{\mathrm{m} / \mathrm{sec}}$.
$=\left(\int_{25}^{2} \times \frac{18}{5}\right)_{k m / h r}$
$=45 \mathrm{~km} / \mathrm{hr}$.
Let the speed of the train be $x \mathrm{~km} / \mathrm{hr}$. Then, relative speed $=(x-5) \mathrm{km} / \mathrm{hr}$.
$\therefore \mid x-5=45 \Rightarrow x=50 \mathrm{~km} / \mathrm{hr}$.
3. The length of the bridge, which a train 130 metres long and travelling at 45 $\mathrm{km} / \mathrm{hr}$ can cross in 30 seconds, is:
A. 200 m
B. 225 m
C. 245 m
D. 250 m

Answer \& Explanation
Answer: Option C

## Explanation:

Speed $=\left(45 \times \frac{5}{18}\right)_{\mathrm{m} / \mathrm{sec}}=\left(\frac{25}{2}\right)_{\mathrm{m} / \mathrm{sec}}$.

Time $=30 \mathrm{sec}$.
Let the length of bridge be $x$ metres.
Then, $\frac{130+x}{30}=\frac{25}{2}$
$\Rightarrow 2(130+x)=750$
$\Rightarrow x=245 \mathrm{~m}$.

## KUSHMANDA IAS ACADEMY

4. Two trains running in opposite directions cross a man standing on the platform in 27 seconds and 17 seconds respectively and they cross each other in 23 seconds. The ratio of their speeds is:
A. $1: 3$
B. $3: 2$
C. $3: 4$
D. None of these

## Answer \& Explanation

## Answer: Option B

## Explanation:

Let the speeds of the two trains be $x \mathrm{~m} / \mathrm{sec}$ and $\mathrm{y} \mathrm{m} / \mathrm{sec}$ respectively.

Then, length of the first train $=27 x$ metres,
and length of the second train $=17 y$ metres.
$\therefore \left\lvert\, \frac{27 x+17 y}{x+y}=23\right.$
$\Rightarrow 27 x+17 y=23 x+23 y$
$\Rightarrow 4 x=6 y$
$\Rightarrow \frac{x}{y}=\frac{3}{2}$.
5. A train passes a station platform in 36 seconds and a man standing on the platform in 20 seconds. If the speed of the train is $54 \mathrm{~km} / \mathrm{hr}$, what is the length of the platform?
A. 120 m
B. 240 m
C. 300 m
D. None of these

Answer \& Explanation
Answer: Option B

## Explanation:

Speed $=\left(\int 54 \times \frac{5}{18}\right)_{\mathrm{m} / \mathrm{sec}}=15 \mathrm{~m} / \mathrm{sec}$.
Length of the train $=(15 \times 20) \mathrm{m}=300 \mathrm{~m}$.
Let the length of the platform be $x$ metres.
Then, $\frac{x+300}{36}=15$
$\Rightarrow x+300=540$
$\Rightarrow x=240 \mathrm{~m}$.
6. A train 240 m long passes a pole in 24 seconds. How long will it take to pass a platform 650 m long?
A. 65 sec
B. 89 sec
C. 100 sec
D. $\quad 150 \mathrm{sec}$

## Answer \& Explanation

## Answer: Option B

## Explanation:

Speed $=(\overbrace{240}^{24})_{\mathrm{m} / \mathrm{sec}=10 \mathrm{~m} / \mathrm{sec} \text {. }}$
$\therefore$ | Required time $=\left(\frac{240+650}{10}\right)_{\text {sec }=89 \mathrm{sec}}$
7. Two trains of equal length are running on parallel lines in the same direction at $46 \mathrm{~km} / \mathrm{hr}$ and $36 \mathrm{~km} / \mathrm{hr}$. The faster train passes the slower train in 36 seconds. The length of each train is:
A. 50 m
B. $\quad 72 \mathrm{~m}$
C. 80 m
D. 82 m

## Answer \& Explanation

Answer: Option A

## Explanation:

Let the length of each train be $x$ metres.

Then, distance covered $=2 x$ metres.
Relative speed $=(46-36) \mathrm{km} / \mathrm{hr}$

$$
\begin{aligned}
& =\left(110 \times \frac{5}{18}\right)_{\mathrm{m} / \mathrm{sec}} \\
& =\left(\frac{25}{9}\right)_{\mathrm{m} / \mathrm{sec}} \\
& \therefore \left\lvert\, \frac{2 x}{36}=\frac{25}{9}\right. \\
& \Rightarrow 2 x=100 \\
& \Rightarrow 1 x=50
\end{aligned}
$$

8. A train 360 m long is running at a speed of $45 \mathrm{~km} / \mathrm{hr}$. In what time will it pass a bridge 140 m long?
A. 40 sec
B. 42 sec
C. 45 sec
D. 48 sec

Answer \& Explanation

Answer: Option A

## Explanation:

Formula for converting from $\mathrm{km} / \mathrm{hr}$ to $\mathrm{m} / \mathrm{s}: \quad X \mathrm{~km} / \mathrm{hr}=\left(X X \times \frac{5}{18}\right) \mathrm{m} / \mathrm{s}$.
Therefore, Speed $=(45 \times \underline{5})=25 \mathrm{~m} / \mathrm{sec}$.

## KUSHMANDA IAS ACADEMY

18
2

Total distance to be covered $=(360+140) \mathrm{m}=500 \mathrm{~m}$.
Formula for finding Time $=(\sqrt{\text { Distance }})$
$\therefore$ | Required time $=\left(\frac{500 \times 2}{25}\right)_{\text {sec }}=40 \mathrm{sec}$.
9. Two trains are moving in opposite directions @ $60 \mathrm{~km} / \mathrm{hr}$ and $90 \mathrm{~km} / \mathrm{hr}$. Their lengths are 1.10 km and 0.9 km respectively. The time taken by the slower train to cross the faster train in seconds is:
A. 36
B. 45
C. 48
D. 49

## Answer \& Explanation

## Answer: Option C

## Explanation:

Relative speed $=(60+90) \mathrm{km} / \mathrm{hr}$

$$
\begin{aligned}
& =\left(1150 \times \frac{5}{18}\right)_{\mathrm{m} / \mathrm{sec}} \\
& =\left(\frac{125}{3}\right)_{\mathrm{m} / \mathrm{sec}}
\end{aligned}
$$

Distance covered $=(1.10+0.9) \mathrm{km}=2 \mathrm{~km}=2000 \mathrm{~m}$.
Required time $=\left(\int 2000 \times \frac{3}{125}\right)_{\mathrm{sec}}=48 \mathrm{sec}$.
10. A jogger running at 9 kmph alongside a railway track in 240 metres ahead of the engine of a 120 metres long train running at 45 kmph in the same direction. In how much time will the train pass the jogger?
A. $\quad 3.6 \mathrm{sec}$
B. 18 sec
C. 36 sec
D. 72 sec

## Answer \& Explanation

Answer: Option C

## Explanation:

Speed of train relative to jogger $=(45-9) \mathrm{km} / \mathrm{hr}=36 \mathrm{~km} / \mathrm{hr}$.
$=\left(\jmath 36 \times \frac{5}{18}\right) \mathrm{m} / \mathrm{sec}$
$=10 \mathrm{~m} / \mathrm{sec}$.
Distance to be covered $=(240+120) \mathrm{m}=360 \mathrm{~m}$.
$\therefore$ I Time taken $=\left(\frac{360}{10}\right)_{\text {sec }}=36 \mathrm{sec}$.

