UDAAN 2025

Maths

Quadratic Equations

DHA : 05

Q1 A journey of 192 km from a town A to town B takes 2 hours more by a ordinary passenger train than a super fast train. If the speed of the faster train is 16 km /h more, find the speeds of the faster and the passenger train.

Q2 A train travels 360 km at a uniform speed. If the speed had been 5 km/h more, it would have taken 1 hour less for the same journey. Find the speed of the train.

(A) 30 km/hr (B) 40 km/hr
(C) 50 km/hr (D) 60 km/hr

Q3 A train travels at a certain average speed for a distance of 63 km and then travels a distance of 72 km at an average speed of 6 km/h more than its original speed. If it takes 3 hours to complete the total journey, what is its original average speed?

(A) 42 km/hr (B) 44 km/hr
(C) 46 km/hr (D) 48 km/hr

Q4 In a flight of 600 km, an aircraft was slowed due to bad weather. Its average speed for the trip was reduced by 200 km/h and time of flight increased by 30 minutes. Find the original duration of flight.

(A) 2.5 hours (B) 1 hour
(C) 2 hours (D) 1.5 hours

Q5 A motor boat, whose speed is 15 km/hr in still water, goes 30 km downstream and comes back in 4 hours 30 minutes. Determine the speed of the stream.

(A) 5 km/hr (B) 6 km/hr
(C) 4 km/hr (D) 3 km/hr

Answer Key

Q1 $Speed\ of\ passenger\ train = 32km/hr$
$Speed\ of\ superfast\ train = 48km/hr$

Q2 (B)

Q3 (A)

Q4 (B)

Q5 (A)

Hints & Solutions

Q1 Text Solution:

Answer:

Let the speed of passenger train be x km/h.

Then, speed of faster train =(x + 16) km/h

According to question:

Time taken to complete the journey by faster train (t_1)hours and time taken by passenger train $(t_2) = \frac{192}{x}$

According to question,

$\therefore \quad \frac{192}{x} - \frac{192}{x+16} = 2$

$\Rightarrow \quad \frac{192[x+16-x]}{x^2+16x} = \frac{2}{1}$

$\Rightarrow \quad \frac{192\times16}{x^2+16x} = \frac{2}{1}$

$\Rightarrow \quad \frac{192\times8}{x^2+16x} = 1$

$\Rightarrow x^2 + 16x - 1536 = 0$

$on\ solving\ using\ Quadratic\ Formula$

$x = 32\ and\ -48$

$as\ speed\ can't\ be\ negative\ x = 32$

$Speed\ of\ passenger\ train = 32km/hr$

$Speed\ of\ superfast\ train = 48km/hr$

Video Solution:

Q2 Text Solution:

Let the speed of the train be s km/hr and the time taken be t hours.

Distance = Speed × Time

360 = s × t

⇒ t = 360 / s

Increased speed of the train can be written as s + 5

New time to cover the same distance = t - 1

(s + 5) × (t - 1) = 360 ....(1)

st - s + 5t - 5 = 360

360 - s + 5(360/s) - 5 = 360 [Since, st = 360 and t = 360 / s]

- s + 1800/s - 5 = 0

$- s^2 + 1800 - 5s = 0$

$s^2 + 5s - 1800 = 0$

We will solve this quadratic equation by Quadratic formula

Comparing $s^2 + 5s - 1800 = 0$ with $ax^2 + bx + c = 0$, we get a = 1, b = 5, c = - 1800

$b^2 - 4ac = (5)^2 - 4(1)(- 1800)$

= 25 + 7200

= 7225 > 0

Hence, the real roots exist.

$x = [-b \pm \sqrt{(b^2 - 4ac)}] / 2a$

$s = (- 5 \pm \sqrt{7225}) / 2$

s = (- 5 ± 85) / 2

s = (- 5 + 85) / 2 and s = (- 5 - 85) / 2

s = 80 / 2 and s = - 90 / 2

s = 40 and s = - 45

Speed of the train cannot be a negative value.

Therefore, speed of the train is 40 km /hr.

Video Solution:

Q3 Text Solution:

Total journey completed in 3 hours.

We know, distance = speed/time

Given, a train travels a distance of 63km at an average speed of x km/hr,

Time = 63/x

Given, same train travels a distance of 72km at an average speed of (x+6)km/hr,

Time = 72/(x+6)

So, 3 = (63/x) + 72/(x+6)

Dividing by 3 on both sides,

1 = 21/x + 24/(x+6)

x(x + 6) = 21(x + 6) + 24(x)

$x^2 + 6x = 21x + 126 + 24x$

By grouping,

$x^2 + 6x - 21x - 24x = 126$

x^2 - 39x - 126 = 0
x^2 - 42x + 3x - 126 = 0
x(x - 42) + 3(x - 42) = 0
(x - 42)(x + 3) = 0
Now, x - 42 = 0
x = 42
Also, x + 3 = 0
x = -3
Since the average speed x cannot be negative, x = 42km/hr
Therefore, the original average speed of the train is 42km/hr

Video Solution:

Q4 Text Solution:

Let the original speed of the aircraft be x km/hr.
then new speed =(x–200) km.hr

Duration of flight at original speed =(600/x)hr

Duration of fight at reduced speed = (600/x–200)hr

∴(600/x–200)–(600/x)=1/2

⇒600x–600(x–20)/x(x–200)=1/2

⇒120000/x2–200x=1/2

⇒x^2–200x–240000=0

⇒x^2–600x+400x–240000=0

⇒(x–600)(x+400)=0

⇒x=600 or x=–400

⇒x=600

So, the origianl speed of the aircraft was 600km/hr

hence, duration of flight =(600/x)hr= (600/600)hr=1hr

Video Solution:

Q5 Text Solution:

Let the speed of the stream be x km/hr.
Then, speed downstream =(15+x) km/hr
and speed upstream =(15–x) km/hr
∴30/(15+x)+30/(15–x)=$4\frac{1}{2}$
⇒30(30)/(15+x)(15–x)=9/2
⇒(15+x)(15–x)=200
⇒225–x^2=200
⇒x^2=25
⇒x=5
Hence, speed of the stream =5 km/hr

Video Solution: