UDAAN 2025

Maths

Quadratic Equations

Q1 The area of a right triangle is 600 cm^2. If the base of the triangle exceeds the altitude by 10 cm , find the dimensions of the triangle.

Q2 A two-digit number is such that the product of the digits is 16. When 54 is subtracted from the number, the digits are interchanged. Find the number.

Q3 The difference of the squares of two positive integers is 180 . The square of the smaller number is 8 times the larger number, find the numbers.

Q4 The perimeter of a rectangular field is 82 m and its area is 400 m^2. Find the breadth of the rectangle.

Q5 A girl is twice as old as her sister. Four years hence, the product of their ages (in years) will be 160 .Find their present ages.

Q6 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

Q7 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

Q8 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

Q9 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 $\text{Base} = 40 \text{ cm}$
$\text{Hypotenuse} = 50 \text{ cm}$
$\text{Altitude} = 30 \text{ cm}$

Q2 Number is 82

Q3 Numbers are 12, 18

Q4 Assuming breadth to smaller, thus breadth = 16m

Q5 Age of sisters – 6 years and girl's age is 12 years

Q6 (B)

Q7 (A)

Q8 (B)

Q9 (A)

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Hints & Solutions

Q1 **Text Solution:**

Let the altitude of the triangle be x cm

Therefore, the base of the triangle will be (x + 10)cm

Area of triangle $= \frac{1}{2}x(x+10) = 600$

$= \frac{1}{2}x\left(x+10\right) = 600$

$\Rightarrow (x+10) = 1200 \Rightarrow (x+10) = 1200$

$\Rightarrow x^2 + 10x - 1200 = 0$

$\Rightarrow x^2 + 10x - 1200 = 0$

$\Rightarrow x^2 + (40-30)x - 1200 = 0$

$\Rightarrow x^2 + \left(40-30\right)x - 1200 = 0$

$\Rightarrow x^2 + 40x - 30x - 1200 = 0$

$\Rightarrow x^2 + 40x - 30x - 1200 = 0$

$\Rightarrow x(x+40) - 30(x+40) = 0$

$\Rightarrow x(x+40) - 30(x+40) = 0$

$\Rightarrow (x+40)(x-30) = 0 \Rightarrow (x+40)(x-30) = 0$

$\Rightarrow x = -40$ or $x = 30 \Rightarrow x = -40$ or $x = 30$

$\Rightarrow x = 30 \Rightarrow x = 30$ [∵ Altitude cannot be negative]

Thus, the altitude and base of the triangle are 30 cm and (30+10=40) cm, respectively.

$\Big($ Hypotenuse ^{2}

$= ($ Altitude $)^2 + ($ Base $)^2$

$\Big($ Hypotenuse $^2 = ($ Altitude $)^2 + ($ Base $)^2$

$\Rightarrow ($ Hypotenuse $)^2 = (30)^2(40)^2$

$\Rightarrow ($ Hypotenuse $)^2 = (30)^2(40)^2$

$\Rightarrow ($ Hypotenuse $)^2 = 900 + 1600 = 2500$

$\Rightarrow ($ Hypotenuse $)^2 = 900 + 1600 = 2500$

$\Rightarrow ($ Hypotenuse $)^2 = (50)^2$

$\Rightarrow ($ Hypotenuse $)^2 = (50)^2$

$\Rightarrow ($ Hypotenuse $) = 50 \Rightarrow ($ Hypotenuse $) = 50$

Thus, the dimensions of the triangle are:

Hypotenuse $= 50$ cm Hypotenuse $= 50$ cm

Altitude $= 30$ cm Altitude $= 30$ cm

Base $= 40$ cm Base $= 40$ cm

Video Solution:

Q2 **Text Solution:**

Let the ones digit be 'a' and tens digit be 'b'. (a>0,b>0)

Given, two-digit number is such that the product of its digits is 16.

$\Rightarrow ab = 16 \cdots (1) \Rightarrow ab = 16 \cdots (1)$

Also, when 54 is subtracted from the number, the digits interchange their places

$\Rightarrow 10b + a - 54 = 10a + b$

$\Rightarrow 10b + a - 54 = 10a + b$

$\Rightarrow 9b - 9a = 54 \Rightarrow 9b - 9a = 54$

$\Rightarrow b - a = 6 \Rightarrow b - a = 6$

$\Rightarrow b = 6 + a \Rightarrow b = 6 + a$

Substituting in 1

$\Rightarrow a \times (6+a) = 16 \Rightarrow a \times (6+a) = 16$

$\Rightarrow a^2 + 6a - 16 = 0 \Rightarrow a^2 + 6a - 16 = 0$

$\Rightarrow a^2 + 8a - 2a - 16 = 0$

$\Rightarrow a^2 + 8a - 2a - 16 = 0$

$\Rightarrow a(a+8) - 2(a+8) = 0$

$\Rightarrow a(a+8) - 2(a+8) = 0$

$\Rightarrow (a-2)(a+8) = 0 \Rightarrow (a-2)(a+8) = 0$

$\Rightarrow a = 2 \Rightarrow a = 2$

Thus, b = 8

Number is 82

Video Solution:

Q3 **Text Solution:**

Let the positive integers be 'a' and 'b'.

Given, difference of the squares of two positive integers is 180 .

$$\Rightarrow a^2 - b^2 = 180$$

Also, square of the smaller number is 8 times the larger.

$$\Rightarrow b^2 = 8a$$

Thus, $a^2 - 8a - 180 = 0$

$$\Rightarrow a^2 - 18a + 10a - 180 = 0$$

$$\Rightarrow a(a - 18) + 10(a - 18) = 0$$

$$\Rightarrow (a + 10)(a - 18) = 0$$

$$\Rightarrow a = -10, 18$$

Thus, the other number is

$$324 - 180 = b^2$$

$$\Rightarrow b = 12$$

Numbers are 12, 18

Video Solution:

Q4   Text Solution:

Perimeter of a rectagle = 2(l + b)

Area of the rectangle = l × b

Given, perimeter of a rectangular field is 82 m and its area is 400 m^2

Let the breadth be 'a' m and length be 'b' m

$$\Rightarrow 2(a + b) = 82$$

$$\Rightarrow b = 41 - a$$

Also, a × b = 400

$$\Rightarrow a \times (41 - a) = 400$$

$$\Rightarrow a^2 - 41a + 400 = 0$$

$$\Rightarrow a^2 - 25a - 16a + 400 = 0$$

$$\Rightarrow a(a - 25) - 16(a - 25) = 0$$

$$\Rightarrow (a - 16)(a - 25) = 0$$

$$\Rightarrow a = 16, 25$$

Assuming breadth to smaller, thus breadth = 16m

Video Solution:

Q5   Text Solution:

Let the present ages of the younger sister be 'a'.

Given, girl is twice as old as her sister.

Age of elder sister = 2a

Also, four years ago, the product of their ages (in years) will be 160.

$$\Rightarrow (a + 4)(2a + 4) = 160$$

$$\Rightarrow 2a^2 + 12a + 16 - 160 = 0$$

$$\Rightarrow a^2 + 6a - 72 = 0$$

$$\Rightarrow a^2 + 12a - 6a - 72 = 0$$

$$\Rightarrow a(a + 12) - 6(a + 12) = 0$$

$$\Rightarrow (a - 6)(a + 12) = 0$$

$$\Rightarrow a = 6 \text{ years}$$

Age of sisters – 6 years and girl's age is 12 years

Video Solution:

Q6   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

$(s + 5) \times (t - 1) = 360$ ....(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.

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

$s = (- 5 \pm \surd 7225) / 2$

$s = (- 5 \pm 85) / 2$

$s = (- 5 + 85) / 2$ 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:

Q7   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, $x = 42$km/hr

Therefore, the original average speed of the train is 42km/hr

Video Solution:

Q8   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

$\therefore (600/x–200)–(600/x)=1/2$

$\Rightarrow 600x–600(x–20)/x(x–200)=1/2$

$\Rightarrow 120000/x^2–200x=1/2$

$\Rightarrow x^2x^2–200x–240000=0$

$\Rightarrow x^2x^2–600x+400x–240000=0$

$\Rightarrow (x–600)(x+400)=0$

⇒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:

Q9 **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)=$4\frac{1}{2}$ $4\frac{1}{2}$

⇒30(30)/(15+x)(15−x)=9/2

⇒(15+x)(15−x)=200

⇒225−$x^2$$x^2$=200

⇒$x^2$$x^2$=25

⇒x=5

Hence, speed of the stream =5 km/hr

Video Solution: