Exercise 4.3

Q6. The diagonal of a rectangular field is 60 metres more than the shorter side. If, the longer side is 30 metres more than the shorter side, find the sides of the field.

Ans. Let shorter side of rectangle = x metres

Let diagonal of rectangle = $(x + 60)$ metres

Let longer side of rectangle = $(x + 30)$ metres

According to pythagoras theorem,

$$(x+60)^2 = (x+30)^2 + x^2$$

$$\Rightarrow x^2 + 3600 + 120x = x^2 + 900 + 60x + x^2$$

$$\Rightarrow x^2 - 60x - 2700 = 0$$

Comparing equation $x^2 - 60x - 2700 = 0$ with standard form $ax^2 + bx + c = 0$,

We get $a = 1$, $b = -60$ and $c = -2700$

Applying quadratic formula $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$$x = \frac{60 \pm \sqrt{(60)^2 - 4(1)(-2700)}}{2 \times 1}$$

$$\Rightarrow x = \frac{60 \pm \sqrt{3600 + 10800}}{2}$$

$$\Rightarrow x = \frac{60 \pm \sqrt{14400}}{2} = \frac{60 \pm 120}{2}$$

$$\Rightarrow x = \frac{60 + 120}{2}, \frac{60 - 120}{2}$$

$$\Rightarrow x = 90, -30$$

We ignore -30. Since length cannot be in negative.

Therefore, $x = 90$ which means length of shorter side = 90 metres

And length of longer side = $x + 30 = 90 + 30 = 120$

metres

Therefore, length of sides are 90 and 120 in metres.

Q7. The difference of squares of two numbers is 180. The square of the smaller number is 8 times the larger number. Find the two numbers.

Ans. Let smaller number = x and let larger number = y

According to condition:

$y^2 - x^2 = 180$ ... (1)

Also, we are given that square of smaller number is 8 times the larger number.

$\Rightarrow x^2 = 8y$ ... (2)

Putting equation (2) in (1), we get

$y^2 - 8y = 180$

$\Rightarrow y^2 - 8y - 180 = 0$

Comparing equation $y^2 - 8y - 180 = 0$ with general form $ay^2 + by + c = 0$,

We get $a = 1$, $b = -8$ and $c = -180$

Using quadratic formula $y = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$$y = \frac{8 \pm \sqrt{(-8)^2 - 4(1)(-180)}}{2 \times 1}$$

$$\Rightarrow y = \frac{8 \pm \sqrt{64 + 720}}{2}$$

$$\Rightarrow y = \frac{8 \pm \sqrt{784}}{2} = \frac{8 \pm 28}{2}$$

$$\Rightarrow y = \frac{8 + 28}{2}, \frac{8 - 28}{2}$$

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

Using equation (2) to find smaller number:

$x^2 = 8y$

$\Rightarrow x^2 = 8y = 8 \times 18 = 144$

$\Rightarrow x = \pm 12$

And, $x^2 = 8y = 8 \times -10 = -80$ {No real solution for x}

Therefore, two numbers are (12, 18) or (−12, 18)

Q8. A train travels 360 km at a uniform speed. If, the speed had been 5 km/hr more, it would have taken 1 hour less for the same journey. Find the speed of the

train.

Ans. Let the speed of the train = x km/hr

If, speed had been 5 km/hr more, train would have taken 1 hour less.

So, according to this condition

$$\frac{360}{x} = \frac{360}{x+5} + 1$$

$$\Rightarrow 360\left(\frac{1}{x} - \frac{1}{x+5}\right) = 1$$

$$\Rightarrow 360\left(\frac{x+5-x}{x(x+5)}\right) = 1$$

$$\Rightarrow 360 \times 5 = x^2 + 5x$$

$$\Rightarrow x^2 + 5x - 1800 = 0$$

Comparing equation $x^2 + 5x - 1800 = 0$ with general equation $ax^2 + bx + c = 0$,

We get $a = 1$, $b = 5$ and $c = -1800$

Applying quadratic formula $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$$x = \frac{-5 \pm \sqrt{(5)^2 - 4(1)(-1800)}}{2 \times 1}$$

$$\Rightarrow x = \frac{-5 \pm \sqrt{25 + 7200}}{2}$$

$$\Rightarrow x = \frac{-5 \pm \sqrt{7225}}{2} = \frac{-5 \pm 85}{2}$$

$$\Rightarrow x = \frac{-5+85}{2}, \frac{-5-85}{2}$$

$$\Rightarrow x = 40, -45$$

Since speed of train cannot be in negative. Therefore, we discard $x = -45$

Therefore, speed of train = 40 km/hr

Q9. Two water taps together can fill a tank in $9\frac{3}{8}$ hours. The tap of larger diameter takes 10 hours less than the smaller one to fill the tank separately. Find the time in which each tap can separately fill the tank.

Ans. Let time taken by tap of smaller diameter to fill the tank = x hours

Let time taken by tap of larger diameter to fill the tank = $(x - 10)$ hours

********** END **********