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Exercise 4.4

i. $2x^2 - 3x + 5 = 0$

$\Rightarrow a = 2, b = -3, c = 5$

$D = b^2 - 4ac$

$= (-3)^2 - 4 \times 2 \times 5$

$= 9 - 40$

$= -31 < 0 \rightarrow$ No real roots

ii. $3x^2 - 4\sqrt{3}x + 4 = 0$

$a = 3, b = -4\sqrt{3}, c = 4$

$D = b^2 - 4ac$

$= (-4\sqrt{3})^2 - 4 \times 3 \times 4$

$= 16 \times 3 - 48$

$= 48 - 48 = 0 = 0 \rightarrow$ Equal roots

iii. $2x^2 - 6x + 3 = 0$

$a = 2, b = -6, c = 3$

$D = b^2 - 4ac$

$= (-6)^2 - 4 \times 2 \times 3$

$= 36$

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

$= \frac{-(-4\sqrt{3}) + \sqrt{(-4\sqrt{3})^2 - 4 \times 3 \times 4}}{2 \times 3}$

$= \frac{4\sqrt{3} \pm \sqrt{48 - 48}}{6} = \frac{4\sqrt{3}}{6}$

$= \frac{2}{\sqrt{3}}$

iii. $2x^2 - 6x + 3 = 0$

$a = 2, b = -6, c = 3$

$d = b^2 - 4ac$

$= (-6)^2 - 4 \times 2 \times 3$

$= 36 - 24$

$= 12 > 0 \rightarrow$ Two distinct roots

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

$$= \frac{-(-6) \pm \sqrt{(-6)^2 - 4 \times 2 \times 3}}{2 \times 2}$$

$$= \frac{6 \pm \sqrt{36 - 24}}{4}$$

$$= \frac{6 \pm \sqrt{12}}{4}$$

$$= \frac{6 \pm 2\sqrt{3}}{4}$$

$$= \frac{3 \pm \sqrt{3}}{2}$$

$$x = \frac{3 + 3\sqrt{2}}{2} \text{ or } x = \frac{3 - 3\sqrt{2}}{2}$$

2. i. $2x^2 + kx + 3 = 0$

$a = 2, b = k, c = 3$

$d = b^2 - 4ac$

$= k^2 - 4 \times 2 \times 3 = k^2 - 24$

For equal roots,

$D = 0$

$\Rightarrow k^2 - 24 = 0$

$\Rightarrow k^2 = 24$, $\therefore k = \pm\sqrt{24}$

$\Rightarrow k = \pm\sqrt{4 \times 6} = 2\sqrt{6}$

ii. $kx(x-2)+6=0$

$= kx^2 - 2kx + 6 = 0$

$a = k, b = -2k, c = 6$

$D = b^2 - 4ac$

$= (-2k)^2 - 4 \times k \times 6$

$= 4k^2 - 24k$

For equal roots $= D = 0$

$\Rightarrow 4k^2 - 24k = 0$

$\Rightarrow k(4k-24) = 0$

$\Rightarrow k = 0$ or $4k - 24 = 0$

$\Rightarrow 4k = 24$

$\Rightarrow k = \frac{24}{4}$ 6

3. Is it possible to design a rectangular mango grove whose length is twice it's breadth, and the area is $800\ m^2$? If so, find it's length and breadth.

Sol^n Let the breadth be of the grove be x m

∴ The length of the rectangular grove $= 2x$ m.

A/Q :- ~~Area~~ Area = length × breadth

$= x \times 2x = 800$

$= 2x^2 = 800$

$= x^2 = \frac{800}{2}$ 400

$= x = \sqrt{400}$

$= x = 20$

Breadth = 20m

length = 2×20

$= 40$ m

4. Is the following situation possible ? If so, determine their present ages. The sum of the ages of two friends is 20 years. Four years ago, the product of their ages in years was 48.

Sol^n Let the present age of one friend be x years

$\therefore$ The present age of other friend $= 20 - x$ years

A/Q $\therefore (x-4)(16-x) = 48$

$\Rightarrow 16x - x^2 - 64 - 4x = 48$

$\Rightarrow x^2 - 20x + 112 = 0$

Here, $a = 1, b = -20, c = 112$

$D = b^2 - 4ac$

$= (-20)^2 - 4 \times 1 \times 112$

$= 400 - 448$

$\therefore -48 < 0 \Rightarrow$ No real roots

No real roots exist. So, the given situation is not possible.

5. Is it possible to design a rectangular park of perimeter 80 m and area 400 m^2 ? If so, find it's length and breadth.

Sol^n Let the length of rectangular park be x m

Then, the perimeter of rectangular park

$= 2(\text{length} + \text{breadth})$

$\Rightarrow 2(x + \text{breadth}) = 80$

$\Rightarrow$ Breadth $= 40 - x$

$\therefore$ Area of rectangular park = length $\times$ breadth

$= x(40-x) = 400$

$= 40x - x^2 = 400$

$= x^2 - 40x + 400 = 0$

$= x^2 - 20x - 20x + 400 = 0$

$= (x-20)(x-20) = 0$

$= x = 20$

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∴ The rectangular park is possible to design : $l = 20m$, $b = 40 - 20 = 20m$