

# Mathematics

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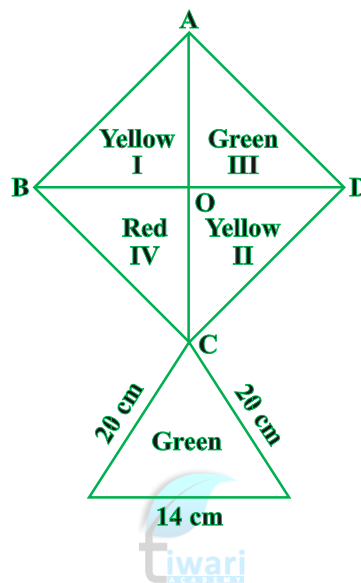
(Chapter – 12) (Heron's Formula)(Exemplar Problems)

(Class – IX)

## Exercise 12.4

### Question 1:

How much paper of each shade is needed to make a kite given in Fig. 12.4, in which ABCD is a square with diagonal 44 cm.



### Answer 1:

We know that, all the sides of a square are always equal.

i.e.,

$$AB = BC = CD = DA$$

In  $\triangle ACD$ ,

$$AC = 44\text{cm}, \angle D = 90^\circ$$

Using Pythagoras theorem in  $\triangle ACD$ ,

$$AC^2 = AD^2 + DC^2$$

$$\Rightarrow 44^2 = AD^2 + AD^2$$

$$\Rightarrow 2AD^2 = 44 \times 44$$

$$\Rightarrow AD^2 = 22 \times 44$$

$$\Rightarrow AD = \sqrt{22 \times 44}$$

[Taking positive square root because length is always positive]

$$\Rightarrow AD = \sqrt{2 \times 11 \times 4 \times 11}$$



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$$\Rightarrow AD = 22\sqrt{2} \text{ cm}$$

$$\text{So, } AB = BC = CD = DA = 22\sqrt{2} \text{ cm}$$

$$\therefore \text{Area of a square } ABCD = \text{Side} \times \text{Side}$$

$$= 22\sqrt{2} \times 22\sqrt{2} = 968\text{cm}^2.$$

$$\therefore \text{Area of the red portion} = \frac{968}{4} = 242\text{cm}^2.$$

[Since, area of square is divide into four parts]

$$\text{Now, area of the green portion} = \frac{968}{4} = 242\text{cm}^2.$$

$$\text{Area of the yellow portion} = \frac{968}{2} = 484\text{cm}^2.$$

In  $\Delta PCQ$ , side  $PC = a = 20\text{cm}$ ,  $CQ = b = 20\text{cm}$  and  $PQ = c = 14\text{cm}$

$$s = \frac{a+b+c}{2} = \frac{20+20+14}{2} = \frac{54}{2} = 27\text{cm}$$

$$\therefore \text{Area of } \Delta PCQ = \sqrt{s(s-a)(s-b)(s-c)} \quad [\text{By Heron's formula}]$$

$$= \sqrt{27(27-20)(27-20)(27-14)}$$

$$= \sqrt{27 \times 7 \times 7 \times 13}$$

$$= \sqrt{3 \times 3 \times 3 \times 7 \times 7 \times 13}$$

$$= 21\sqrt{39}$$

$$= 21 \times 6.24$$

$$= 131.04\text{cm}^2$$

$$\therefore \text{Total area of the green portion} = 242 + 131.04 = 373.04\text{cm}^2$$

Hence, the paper required for each shade to make a kite is red paper  $242\text{cm}^2$ , yellow paper  $484\text{cm}^2$  and green paper  $373.04\text{cm}^2$ .

