CBSE X 2020 : MOST IMPORTANT QUESTIONS FOR STANDARD MATHEMATICS

A boat goes 30 km upstream and 44 km downstream in 10 hours. In 13 hours‘ it can go 40 km upstream and 55 km downstream. Determine the speed of the stream and that of the boat in still water.

Let speed of boat in still water be x km/h and speed of stream be y km/h .

Speed upstream=(x-y) km/h

Speed downstream=(x+y) km/h

Let $\frac{1}{x-y} = a$ and $\frac{1}{x+y} = b$

$\frac{30}{x-y} + \frac{44}{x+y} = 10 \Rightarrow 30a + 44b = 10 \Rightarrow 120a + 176b = 40$

$\frac{40}{x-y} + \frac{55}{x+y} = 13 \Rightarrow 40a + 55b = 13 \Rightarrow 120a + 165b = 39$

On subtracting, we get,

b= $\frac{1}{11}$

$\therefore 30a + 4 = 10 \Rightarrow 30a = 6 \Rightarrow a = \frac{1}{5}$

$\therefore x - y = 5 \, and \, x + y = 11$

On solving, we get

x=8 , y=3

$\therefore$ Speed of boat in still water= 8 km/h

And, Speed of stream = 3 km/h

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During the medical check-up of 35 students of a class their weights were recorded as follows:

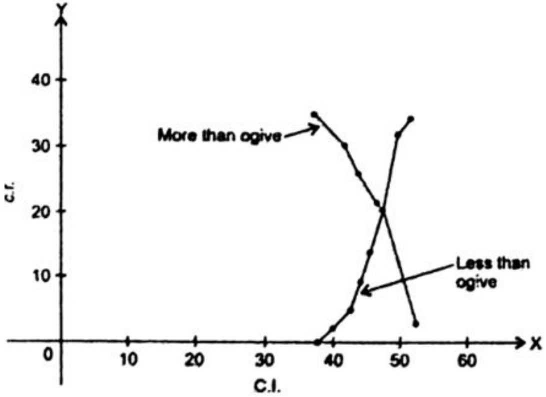
Weight (in. kg.)	38-40	40-42	42-44	44-46	46-48	48-50	50-52
No. of students	3	2	4	5	14	4	3

Draw a less than type and a more than type ogive from the given data.Hence obtain the median weight from the graph.

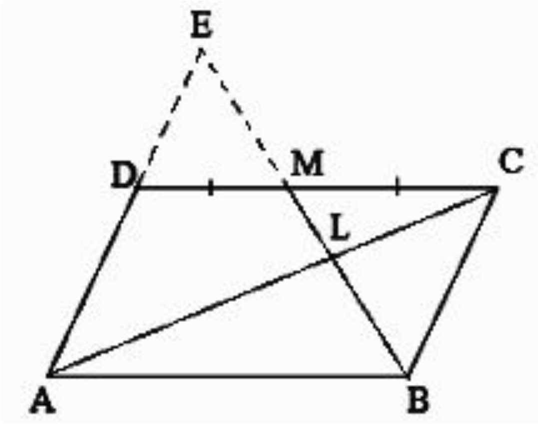
Classes	f	c.f		c.f.	
38-40	3	3	(40,3)	35	(38,35)
40-42	2	5	(42,5)	32	(40,32)
42-44	4	9	(44,9)	30	(42,30)
44-46	5	14	(46,14)	26	(44,26)
46-48	14	28	(48,28)	21	(46,21)
48-50	4	32	(50,32)	7	(48,7)
50-52	3	35	(52,35)	3	(50,3)

We plot the points (40,3), (42,5), (44,9), (46,14),(48,28), (50,32),(52,35). We join these points with a smooth curve to get the ‘less than’ ogive as shown in Fig.

Then, we plot the points (38,35), (40,32),(42,30), (44,26),(46,21),(48,7), (50,3) on the same axes. By joining these points with a smooth curve to get ‘more than’ ogive. Since, the two curves intersect at the point, whose abscissa is 47 (approx). Hence, the required median weight is 47 kg (approx.).



Through the midpoint of M of the side CD of a parallelogram ABCD, the line BM is drawn intersecting AC in L and AD produced in E. Prove that EL = 2BL



$Given$: $ABCD$ is a parallelogram, M is the midpoint of CD.

BM intersects AC at L and AD produced at E.

$To\,prove$: $EL = 2BL$

Proof : In ΔBMC and ΔEDM

$\angle DEM = \angle MBC$ (alternate angles)

$\therefore \Delta BMC \cong \Delta EDM$ (ASA congruence)

$\therefore DE = BC$ $(c.\ p.\ c.\ t)$

But $BC = AD$ (opposite sides of parallelogram $ABCD$)

$\therefore AD = DE \Rightarrow AE = 2AD = 2BC$

In ΔAEL and ΔCBL

$\angle ALE = \angle BLC$ (Vertically opposite angles)

$\angle AEL = \angle LBC$ (alternate angles)

$\therefore \Delta AEL = \angle CBL$ (AA similarity axiom)

$$\Rightarrow \frac{AE}{BC} = \frac{AL}{LC} = \frac{EL}{BL}$$

$$\Rightarrow \frac{EL}{BL} = \frac{AE}{BC}$$

$$\Rightarrow \frac{EL}{BL} = \frac{AD+DE}{BC}$$

$$\Rightarrow \frac{EL}{BL} = \frac{BC+BC}{BC}$$

$$\Rightarrow \frac{EL}{BL} = \frac{2BC}{BC}$$

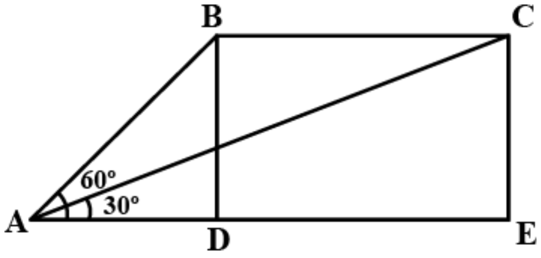
$$\Rightarrow \frac{EL}{BL} = 2$$

$$\therefore EL = 2BL$$

The angle of elevation of an aeroplane from point A on the ground is 60°. After flight of 15 seconds, the angle of elevation changes to 30°. If the aeroplane is flying at a constant height of 1500 $\sqrt{3}m$, find the speed of the plane is k,/hr.

Height of aeroplane $= BD = CD = 1500\sqrt{3}m$ and

$\angle BAE = 60^\circ$ and $CAE = 30^\circ$



In traingle ADB $\tan 60^\circ = \frac{150\sqrt{3}}{AD}$

$\Rightarrow \sqrt{3} = \frac{1500\sqrt{3}}{AD}$

$\Rightarrow AD = 1500\,m$

In triangle CAE $\tan 30^\circ = \frac{1500\sqrt{3}}{AE}$

$\Rightarrow \frac{1}{\sqrt{3}} = \frac{1500\sqrt{3}}{AD}$

$\Rightarrow AE = 1500 \times 3 = 4500\,m$

Distance covered by plane in 15 second :

$BC = DE = AE - AD = 4500 - 1500 = 3000\,m$

Speed of aeroplane $= \frac{3000}{15} = 200\,m/s = 720\,km/hr$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A hemispherical tank, full of water, is emptied by a pipe at the rate of $\frac{25}{7}$ litres per sec. How much time will it take to empty half the tank if the diameter of the base of the tank is 3 m?

Let $r\,m$ be the radius of the hemispherical tank, then

$r = \frac{3}{2}m.$

Now, volume of hemispherical tank

$= \frac{2}{3}\pi r^3$

$= \left(\frac{2}{3} \times \frac{22}{7} \times \frac{3}{2} \times \frac{3}{2} \times \frac{3}{2}\right)m^3$

And, Volume of water to be emptied

$= \frac{1}{2}\left(\text{Volume of hemispherical tank}\right)$

$= \left(\frac{1}{2} \times \frac{99000000}{14}\right)cm^3$

$= \frac{99000}{28} litres$

Hence,

Time taken to half empty the tank

$= \frac{99000}{28} \times \frac{7}{25}$ seconds

$= 16.5$ minutes.

Draw a circle of radius 4 cm. Construct a pair of tangents to it, the angle between which is 60^0. Also justify the construction. Measure the distance between the centre of the circle and the point of intersection of tangents

Steps of construction:

Step I : Draw a circle with centre O and radius 4 cm.

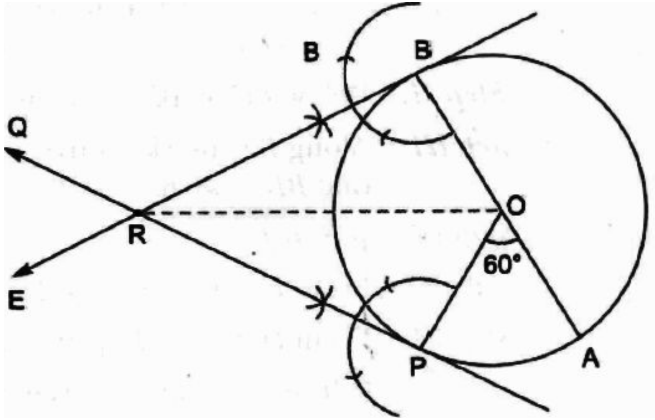
Step II : Draw any diameter AOB.

Step III : Make $\angle AOP = 60^0$. OP is radius which intersect at R.

Step IV : Draw PQ $\perp$ OP and BE $\perp$ OB. PQ and BE intersect at R.

Step V : Hence, RB and RP are the required tangents.

Step VI : Measure of OR = 8 cm.



Justification:

$\therefore$ $\angle OPQ = 90^0$ $\Rightarrow$ PR is a tangent to the circle.

Also $\angle OBR = 90^0$ $\Rightarrow$ BR is a tangent to the circle.

Now, $\angle POB = 180 - 60 = 120^0$

$\therefore$ In □ BOPR,

$\angle BRP = 360^0 - (120^0 + 90^0 + 90^0) = 60^0$

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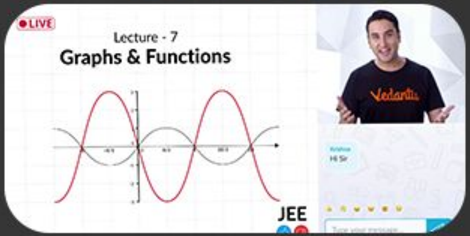

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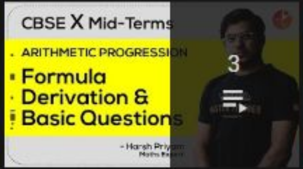

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