



## MATHS

### BOOKS - CHETAN MATHS (TAMIL ENGLISH)

### CHALLENGING QUESTIONS

#### Linear Equations In Two Variables

1. The weight of a bucket is 15kg, when it is filled with water upto  $\frac{3}{5}$  of its capacity and the weight is 19kg, if it is filled with water upto  $\frac{4}{5}$  of its capacity. Find the weight of bucket, if it is completely filled with water.

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2. Abdul travelled 300 km by train and 200 km by taxi, it took him 5 hours 30 minutes. But if he travels 260 km by train and 240 km by taxi, he takes

6 minutes longer. Find the speed of the train and that of the taxi.



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3. When the son will be as old as his father today, the sum of their ages then will be 126, when the father was as old as his son is today, the sum of their ages then was 38. Find their present ages.



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4. The forewheel of a carriage makes 6 revolutions more more than the rearwheel in going 120 m. If the diameter of the forewheel be increased by  $\frac{1}{4}$  its present diameter and the diameter of the rearwheel be increased by  $\frac{1}{5}$  of its present diameter, then the forewheel makes 4 revolutions more than the rearwheel in going the same distance. Find the circumference of each wheel of the carriage.



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5. Find the area of the triangle formed by the following lines and X axis.

$$4x - 3y + 4 = 0 \text{ and } 4x + 3y - 20 = 0$$

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6. Solve:  $2^x + 3^y = 17$ ,  $2^{x+2} - 3^{y+1} = 5$

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7. A person deposits Rs. X in savings bank account at the rate of 5% per annum and Rs. Y in fixed deposit at 10% per annum. At the end of one year, he gets Rs. 400 as total interest. If he deposits Rs. Y in savings bank account and Rs. X in fixed deposit, he would get Rs. 350 as total interest. Find the total amount he deposited.

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8. The sum of the digits of a number consisting of three digits is 12. The middle digit is equal to half of the sum of the other two. If the order of the digit be reversed, the number is diminished by 198. Find the number.

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9. A train covered a certain distance at a uniform speed. If the train would have been 6 km/hr faster, it would have taken 4 hours less than the schedule time. And, if train were slower by 6 km/hr, it would have taken 6 hours more than the schedule time. Find the length of the journey.

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10.

Solve:

$$(a - b)x + (a + b)y = a^2 - 2ab - b^2 \text{ and } (a + b)(x + y) = a^2 + b^2$$

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1. Two trains leave a railway station at the same time. The first train travels due west and the second train due north. The first train travels 5 km/hr faster than second train. If after two hours, they are 50 km apart, find the speed of each train.

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2. If the sum of the roots of the quadratic equation  $ax^2 + bx + c = 0$  is equal to the sum of the squares of their reciprocals, then prove that  $2a^2c = c^2b + B^2a$ .

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3. If the roots of the quadratic equation  $ax^2 + cx + c = 0$  are in the ratio  $P : q$  then show that  $\sqrt{\frac{p}{q}} + \sqrt{\frac{q}{p}} + \sqrt{\frac{c}{a}} = 0$

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4. A businessman bought some items for Rs. 600. Keeping 10 items for himself he sold the remaining items at a profit of Rs. 5 per item. From the amount received in this deal he could buy 15 more items. Find the original price of each item.

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5. A man travels by boat 36 km down a river and back in 8 hours. If the speed of his boat in still water is 12 km/hr, find the speed of the river current.

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6. A number consists of two digits whose product is 56. When 9 is subtracted from the number, the digits interchange their places. Find the number.





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7. Two pipes running together can fill a cistern in  $3\frac{1}{13}$  minutes. If one pipe takes 3 minutes more than the other to fill it, find the time in which each pipe would fill the cistern.



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8. If the sum of roots of the quadratic equation is  $\frac{1}{x+p} + \frac{1}{x+q} = \frac{1}{r}$  is zero, show that the product of the roots is  $-\left(\frac{p^2 + q^2}{2}\right)$



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9. Solve :  $\sqrt{x^2 - 16} - \sqrt{x^2 - 8x + 16} = \sqrt{x^2 - 5x + 4}$



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1. 200 logs of wood are stacked in the following manner: 20 logs in the bottom row, 19 in the next row, 18 in the row next to it and so on. In how many rows 200 logs are placed and how many logs are there in the top row ?

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2. If sum of  $m$  terms is  $n$  and sum of  $n$  terms is  $m$ , then show that the sum of  $(m + n)$  terms is  $-(m + n)$ .

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3. How many terms of the A.P. 16,14,12,...are needed to obtain the sum 60 ?  
Explain why we get two answers.

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4. If  $p^{th}$ ,  $q^{th}$  and  $r^{th}$  terms of an A. P. are  $l$ ,  $m$ ,  $n$ , respectively, show that

$$(q - r)l + (r - p)m + (p - q)n = 0$$



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5. Jinal saves Rs.1600 during the first year, Rs. 2100 in the second year, Rs. 2600 in the third year, If she continues her saving in this pattern, in how many years will she save Rs. 38,500?



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6. Find the middle term of sequence formed by all three digit numbers which leave a remainder 3 when divided by 4. Also find sum of all numbers on both sides of the middle term.



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1. Mr. Modi invested Rs. 30,120 in equity shares of FV Rs. 10 when the market value was Rs. 60. After receiving dividend on them at 90%, he sold them at MV of Rs.55. In each transaction he paid 0.4% brokerage. What was the total gain or loss in this transaction ?



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2. Usha joshi invested an equal amount in two companies by purchasing equity shares with MV Rs.145 and Rs 160 each. The FV is same and it is Rs. 100 for both the shares. At the end of the year, both companies declared the dividends at 20% and 30% each, In which company was her investment profitable?



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3. Mr. Deepak pal invested Rs. 1,00,354 in shares of FV Rs.100, when the market value is Rs 50. Rate of brokerage is 0.3% and rate of GST on

brokerage is 18%, then how many shares were purchased?



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4. Star Pharma purchased some chemical for Rs 8000 (with GST) and sold it to the M/s. Pooja Chemicals for Rs. 10,000 (with GST), Rate of GST is 18%. Find the amount of CGST and SGST to be paid by Star Pharma



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5. A manufacturer sold electric goods for a taxable value of Rs. 40,000 to the wholesaler. Wholesaler sold it to the retailer for Rs. 48,000 (taxable value). Retailer sold it to a customer for Rs. 52,000 (taxable value). Rate of GST is 18%. Find the CGST and SGST payable at each stage of trading. Also show statement of GST payable at each stage of trading.



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6. Mr. Joshi purchased 250 shares of FV Rs 100 for MV of Rs. 500. Find the sum invested. After taking 40% dividend, he sold all the shares when market value was Rs 400. He paid 0.1% brokerage for each trading done. Find the percentage of profit or loss in the share trading.

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## Probability

1. Two customers Sumit and Amit are visiting a particular shop in the same week (Tuesday to Saturday). Each is equally likely to visit the shop on any day as on another day. What is the probability that both will visit the shop on : (i) the same day (ii) different days (iii) consecutive days.

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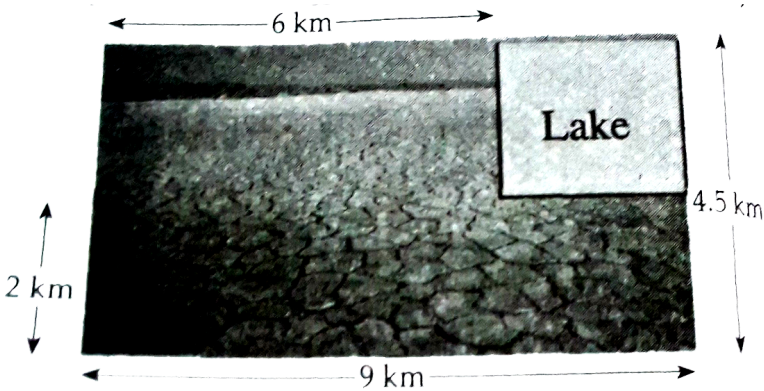
2. What is the probability that an ordinary year has 53 sundays?

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3. What is the probability that a leap year has 53 sundays?

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4. A missing helicopter is reported to have crashed somewhere in the rectangular region as shown in figure. What is the probability that it crashed inside the lake shown in the figure?



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5. Each coefficient in equation  $ax^2 + bx + c = 0$  is obtained by throwing an ordinary die. Find the probability that the equation has real roots.

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6. A box contains 12 balls, out of which  $x$  are black, (i) If one ball is drawn at random, what is the probability that it will be a black ball? (ii) If 6 more black balls are put in the bag, the probability of drawing a black ball will double than that in (i), find  $x$ .

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## Statistics

1. The mean of the following frequency distribution is 50. Find the value

<b>Class interval</b>	10 - 20	20 - 40	40 - 60	60- 80	80 - 100
<b>Frequency</b>	14	$f$	32	24	19

of  $f$ :

2. An incomplete frequency distribution is given as follows:

Class interval	Frequency
10 - 20	12
20 - 30	30
30 - 40	?
40 - 50	65
50 - 60	?
60 - 70	25
70 - 80	18
<b>Total</b>	<b>229</b>

Given that median value is 46, determine the missing frequencies using the medians formula.

3. The following data gives the information on the observed life-time (in hour) of 225 electrical components Find mode:

Life-time (in hours)	Frequency
0 - 20	10
20 - 40	35
40 - 60	52
60 - 80	61
80 - 100	38
100 - 120	29



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4. The adjoining pie-diagram shows the percentage distribution of the expenditure incurred in publishing a book. Study the diagram and answer the questions:

- (a) If for certain quantity of books, the publisher has to pay Rs.30,600 as printing, then what will be the amount of Royalty to be paid for these books?
- (b) What is the central angle of the sector corresponding to the expenditure incurred on Royalty?



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1. Bisector of  $\angle B$  and  $\angle C$  in  $\triangle ABC$  meet each other at P. Line Ap cuts the side BC at Q. Then prove that :  $\frac{AP}{PQ} = \frac{AB + BC}{BC}$



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2. In  $\square ABCD$ , side  $BC \parallel$  side  $AD$ . Diagonal AC and diagonal BD intersects in point Q. If  $AQ = \frac{1}{3}AC$ , then show that  $DQ = \frac{1}{2}BQ$ .



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3. A line cuts two sides AB and side AC of  $\triangle ABC$  in point P and Q respectively.

Show that  $\frac{A(\triangle ABC)}{A(\triangle APQ)} = \frac{AP \times AQ}{AB \times AC}$





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4. In the adjoint figure, AD is the bisector of the exterior  $\angle A$  of  $\triangle ABC$ . Seg AD intersects the side BC produced in D.

Prove that :  $\frac{BD}{CD} = \frac{AB}{AC}$



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5. In the adjoint figure, each of the segments PA, QB, RC and SD is perpendicular to l. If AB =6, BC=9, CD=12, PS=36, then determine PQ, QR and RS.



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6. Let X be any point on side BC of  $\triangle ABC$ , XM and XN are drawn parallel to BA and CA. MN meets in T. Prove that  $TX^2 = TB \cdot TC$ .



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7. Two triangles,  $\triangle ABC$  and  $\triangle DBC$ , lie on the same side of the base BC. From a point P on BC,  $PQ \parallel AB$  and  $PR \parallel BD$  are drawn. They intersect AC at Q DC at R. Prove that  $QR \parallel AD$ .



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8. In  $\triangle ABC$ , D is a point on BC such that  $\frac{BD}{DC} = \frac{AB}{AC}$ . prove that AD is the bisector of  $\angle A$ . (Hint :produce BA to E such that  $AE=AC$ . Join EC)



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9. In the adjoining figure,  $\square ABCD$  is a square.  $\triangle BCE$  on side BC and  $\triangle ACF$  on the diagonal AC are similar to each other. Then, show that

$$A(\triangle BCE) = \frac{1}{2}A(\triangle ACF)$$



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## Theorem Of Pythagoras

1. In  $\triangle PQR$ ,  $\angle PQR = 90^\circ$ , as show in figure, seg  $QS \perp$  side  $PR$ , seg  $QM$  is angle bisector of  $\angle PQR$ .

Prove that : 
$$\frac{PM^2}{MR^2} = \frac{PS}{SR}$$



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2.

In

$\triangle ABC$ ,  $m \angle BAC = 90^\circ$ , seg  $DE \perp$  side  $AB$ , seg  $DF \perp$  side

Prove :  $A(\square AEDF) = \sqrt{AE \times EB \times AF \times FC}$

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3. In  $\triangle ABC$ ,  $\angle ACB = 90^\circ$ ,

seg  $CD \perp$  side  $AB$ ,

$DE \perp$  side  $CB$ ,

Show that :  $CD^2 \times AC = AD \times AB \times DE$

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4. In an equilateral  $\triangle ABC$ , the side  $BC$  is trisected at  $D$ . Prove that

$9AD^2 = 7AB^2$ . (Hint :  $AE \perp BC$ )

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5. In  $\triangle ABC$ ,  $\angle ABC = 135^\circ$ .

Prove that :  $AC^2 = AB^2 + BC^2 + 4A(\triangle ABC)$ .

Construction : Draw seg  $AD \perp \text{side } BC$ , such that D-B-C.



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6. In  $\triangle PQR$  is a right angled triangle, right angled at Q such that  $QR = b$  and  $A(\triangle PQR) = a$ . If  $QN \perp PR$ , then show that  $QN = \frac{2a \cdot b}{\sqrt{b^2 + 4a^2}}$ .



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7. In  $\square ABCD$  is a quadrilateral. M is the midpoint of diagonal AC and N is the midpoint of diagonal BD. Prove that :  $AB^2 + BC^2 + CD^2 + DA^2 = AC^2 + BD^2 + 4MN^2$ .



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1. From the end points of a diameter a diameter of circle perpendiculars are drawn to a tangent of the same circle. Show their feet on the tangent are equidistant from the centre of the circle.

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2. The bisectors of the angles A, B of  $\triangle ABC$  intersect in I, the bisectors of the corresponding exterior angles intersect in E. Prove that  $\square AIBE$  is cycle.

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3. In a right angled  $\triangle ABC$ ,  $\angle ACB = 90^\circ$ . A circle is inscribed in the triangle with radius  $r$ ,  $a, b, c$  are the lengths of the sides BC, AC and AB respectively. Prove that  $2r = a + b - c$ .



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4. If two consecutive angles of cyclic quadrilateral are congruent, then prove that one pair of opposite sides is congruent and other is parallel.

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5. As shown in the adjoining figure, two circles intersect each other in points A and B. Two tangents touch these circles in points P, Q and R, S as shown. Line AB intersects seg PQ in C and seg RS in D. Show that C and D are midpoints of seg PQ and seg RS respectively.

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6.  $\square ABCD$  is a parallelogram. A circle passing through D, A, B cuts BC in P. Prove that  $DC=DP$ .

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7. In a cyclic quadrilateral ABCD, the bisectors of opposite angles A and C meet the circle at P and Q respectively. Prove that PQ is a diameter of the circle.



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8. In  $\triangle ABC$ ,  $\angle A$  is an obtuse angle, P is the circumcentre of  $\triangle ABC$ .

prove that  $\angle PBC = \angle A - 90^\circ$



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9. Two circles with centres O and P intersect each other in points C and D.

Chord AB of the circle with centre O touches the circle with centre P in point E.

Prove that  $\angle ADE + \angle BCE = 180^\circ$



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1. Draw a  $\triangle ABC$  with side  $BC=6$  cm,  $\angle B = 45^\circ$  and  $\angle A = 100^\circ$ , then construct a triangle whose sides are  $\frac{4}{7}$  times the corresponding sides of  $\triangle ABC$ .

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2. Draw a  $\triangle ABC$ , right angled at B such that  $AB=3$ cm and  $BC=4$  cm. Now, construct a triangle similar to  $\triangle ABC$ , each of whose sides is  $\frac{2}{5}$  times the corresponding sides of  $\triangle ABC$ .

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3.  $\triangle AMT \sim \triangle GHE$ , construct  $\triangle AMT$  such that  $MA = 6.3$ cm,  $\angle MAT = 120^\circ$ ,  $AT = 4.9$ cm and  $\frac{MA}{HG} = \frac{7}{5}$ , then construct  $\triangle GHE$ .

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4.  $\Delta LTR \sim \Delta HYD$ . Construct  $\Delta HYD$ , where  $HY = 7.2\text{cm}$ ,  $YD = 6\text{cm}$ ,  $\angle Y = 40^\circ$  and  $\frac{LR}{HD} = \frac{5}{6}$  and construct  $\Delta LTR$ .



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5. Draw a circle with centre O and radius 3.5 cm. Draw tangents PA and PB to the circle, from a point p outside the circle, at points A and B respectively.  $\angle APB = 80^\circ$ .



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6. Draw a circle with centre A and radius 4 cm. Draw tangent segments PQ and PR from an external point P such that  $PQ=PR=3$  cm. Find AP



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1. If  $A(-14, -10)$ ,  $B(6, -2)$  is given, find the co-ordinates of the points which divide segment AB into four equal parts.

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2. If  $A(20, 10)$ ,  $B(0, 20)$  are given, find the co-ordinates of the points which divide segment AB into five congruent parts.

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3. Find the coordinates of the circumcentre and the radius of the circumcircle of  $\triangle ABC$  if  $A(2,3)$ ,  $B(4,-1)$  and  $C(5,2)$ .

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4. Point  $M(-3,7)$  and  $N(-1,6)$  divides segment AB into three equal parts. Find the coordinates of point A and Point B.



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5. Segment AB is divided into four equal parts by point P, Q and R such that A-P-Q-R-B. If (12,9) and R(0,11) then find the coordinates of point A, Q and B.



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6. If (-7,6),(8,5) and (2,-2) are the midpoints of the sides of a triangle. Find the coordinates of its centroid.



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## Trigonometry

1. If  $\sqrt{1+x^2} \sin \theta = x$ , Prove that  $\tan^2 \theta + \cot^2 \theta = x^2 + \frac{1}{x^2}$



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2. Prove:  $\frac{\tan \theta}{1 - \cot \theta} + \frac{\cot \theta}{1 - \tan \theta} = 1 + \tan \theta + \cot \theta$

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3. Prove:

$$\sin^8 \theta - \cos^8 \theta = (\sin^2 \theta - \cos^2 \theta)(1 - 2 \sin^2 \theta \cos^2 \theta)$$

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4. A 1.5 m tall boy is standing at some distance from a 30 m tall building.

The angle of elevation from his eye to the top of the building increase from  $30^\circ$  to  $60^\circ$  as he walks towards the building. Find the distance he walked towards the building.

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5. Prove :

$$(\sin A + \csc A)^2 + (\cos A + \sec A)^2 = 7 + \tan^2 A + \cot^2 A.$$



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6. Prove that :

$$\frac{\tan A}{\sec A - 1} + \frac{\tan A}{\sec A + 1} = 2 \cos ec A$$



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7. From the top of a light house, 80 meters high, two ship on the same side of light house are observed. The angles of depression of the ships as seen from the light house are found to be of  $45^\circ$  and  $30^\circ$ . Find the distance between the two ships. (Assume that the two ships and the bottom of the lighthouse are in line )



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8. If  $a \cos \theta + b \sin \theta = m$  and  $a \sin \theta - b \cos \theta = n$ , then Prove that  $a^2 + b^2 = m^2 + n^2$



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9. If  $\sqrt{3}\tan\theta = 3\sin\theta$ , find the value of  $\sin^2\theta = \cos^2\theta - \cos^2$ , where  $\theta \neq 0$ .

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10. prove that:

$$\left(1 + \frac{1}{\tan^2 A}\right) \left(1 + \frac{1}{\cot^2 A}\right) = \frac{1}{\sin^2 A - \sin^4 A}$$

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## Mensuration

1. A tin maker converts a cubical metallic box into 10 cylindrical tins. Side of the cube is 50 cm and radius of the cylindrical is 7cm. Find the height of each cylinder so made if the wastage incurred was 12%.  $\left(\pi = \frac{22}{7}\right)$

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2. The three faces, A,B,C having a common vertex of a cuboid have areas  $450\text{cm}^2$ ,  $600\text{cm}^2$  and  $300\text{cm}^2$  respectively. Find the volume of the cuboid.

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3. Oil tins of cuboid shape are made from a metallic sheet with length 8m and breadth 4m. Each tin dimension  $60 \times 40 \times 20$  in cm and is open from the top. Find the number of such tins that be made ?

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4. Plastic drum of cylinder shape is made by melting spherical solid plastic balls of radius 1cm Find the number of balls required to make a drum of thickness 2cm, height 90 cm and outer radius 30cm.

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5. Water drips from a tap at the rate of 4 drops in every 3 seconds. Volume of one drop of  $0.4\text{cm}^3$  If dripped water is collected in a cylinder vessel of height 7 cm and diameter is 8 cm In what time vessel be completely filled ? What is the volume of water collectd? How many such vessels will be completely in 3 hours in 40 minutes?



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6. A cone and a hemisphere have equal bases and equal volumes. Find the ratio of their height.



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7. A sphere and a cube have the same surface area. Show that the ratio of the volume of the sphere to that of cube is  $\sqrt{6} : \sqrt{\pi}$ .



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8. Rs 5 coin were made by melting a solid cuboidal block of metal with dimension  $16 \times 11 \times 10$  in cm. How many coins of thickness 2 mm and diameter 2 cm can be made.  $\left(\pi = \frac{22}{7}\right)$

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9. If the radius of a sphere is doubled, what will be the ratio of its surface area and volume as to that of the first sphere?

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