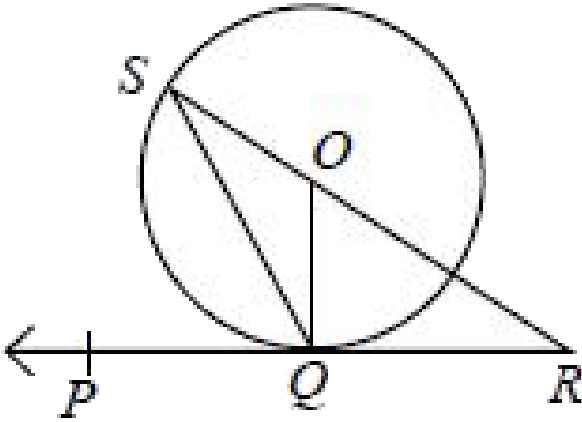# MATHS

BOOKS - HT Olympiad Previous Year Paper

IMO QUESTION PAPER 2017 SET A

Mathematical Reasoning

1. In the given figure, PQR is a tangent to the circle with centre O. OQ is the radius of the circle at the point of contact. R and O are joined and produced to the point S on the circle. If $\angle QRO = 28°$, $\angle QOR = x$ and

$\angle OQS = y$, then find the value of x and y respectively.

A. $31°$, $31°$

B. $62°$, $62°$

C. $62°$, $31°$

D. $90°$, $45°$

Answer: C

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2. Find the roots of the equation

$$\frac{1}{a+b+x} - \frac{1}{x} = \frac{1}{a} + \frac{1}{b}?$$

A. a,b

B. $-a, b$

C. a,-b

D. $-a, -b$

Answer: D

3. From a pack of 52 cards, a card is chosen at random. Find the probability that the chosen card is :

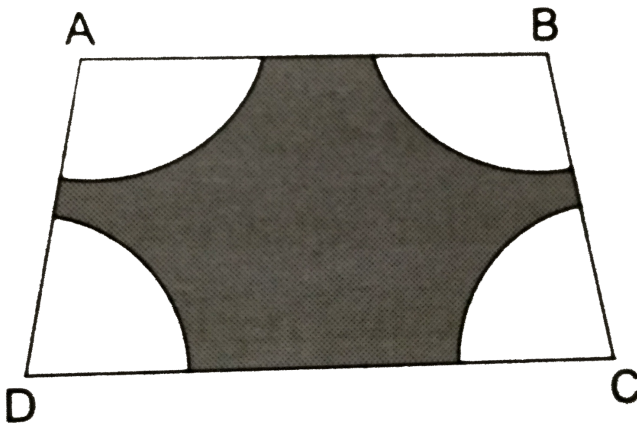(i) A black king.

(ii) Neither a heart nor a king.

A.
	(i)	(ii)
	$\frac{1}{26}$	$\frac{7}{13}$

	(i)	(ii)
B.	$\frac{1}{13}$	$\frac{9}{13}$
C.	$\frac{1}{13}$	$\frac{7}{13}$
D.	$\frac{1}{26}$	$\frac{9}{13}$

Answer: D

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4. In the given figure ABCD is a trapezium in which $AB \mid\mid DC$, $AB = 18cm$, $DC = 32cm$ and the distance between AB and DC is 14 cm. If arcs of equal radii 7 cm hav been drawn with centres A,B,C and D then find the area of the shaded region.

A. 196 cm^2

B. 225 cm^2

C. 350 cm^2

D. 154 cm^2

Answer: A

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5. The side of solid metallic cube is 20 cm. The cube is melted and recast into 8 equal solid cubical dice. Determine the side of the dice.

A. 2.8 cm

B. 3 cm

C. 8 cm

D. 2.5 cm

Answer: D

6. A point P divides the line joining the points (2, 1) and (5, -8) in ratio 1:2. Also, the point P lies on the line $2x - y + k = 0$. Find the value of k.

A. 8

B. -8

C. -6

D. 6

Answer: B

7. In an AP, it is given that $S_5 + S_7 = 167$ and $S_{10} = 235$, then find the AP, where S_n denotes the sum of its first n terms.

A. 1, 6, 11, 16, 21, ...

B. 1,5,9, 13, 17, ...

C. 2, 8, 14, 20, 26,. . . . .

D. 2, 5, 8, 11, 14, ...

Answer: A

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8. If α and β are the zeroes of the polynomial $x^2 + 4x + 3 = 0$,find the polynomial whose zeroes are $1 + \dfrac{\beta}{\alpha}$ and $1 + \dfrac{\alpha}{\beta}$

A. $x^2 + 16x + 16$

B. $x^2 - 16x + 16$

C. $3x^2 - 16x + 16$

D. $3x^2 + 16x + 16$

Answer: C

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9. The decimal representation of $\dfrac{3}{2^{15} \times 5^{10}}$ will terminate after how many places of decimals?

A. 15

B. 10

C. 5

D. None of these

Answer: A

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10. Determine the values of m and n so that the following system of linear equations have infinite number of solutions: . $3x + (n - 1)y - 2 = 0$

A. $\dfrac{11}{2}, \dfrac{17}{2}$

B. $\dfrac{17}{5}, \dfrac{11}{5}$

C. $\dfrac{17}{4}$, $\dfrac{11}{5}$
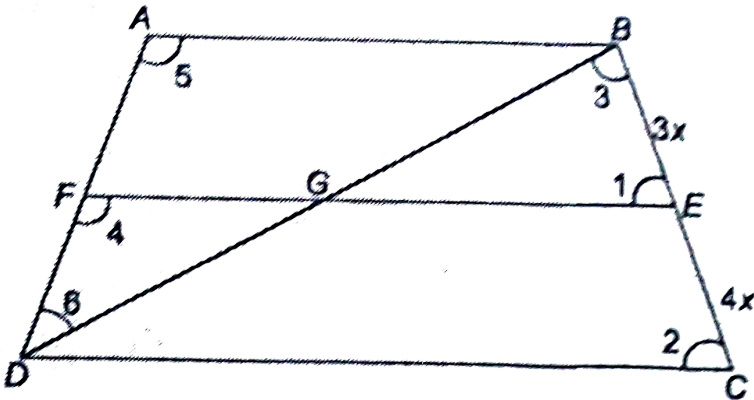
D. $\dfrac{17}{4}$, $\dfrac{11}{2}$

Answer: C

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11. In trapezium ABCD. AB||DC and DC = 2AB. A line segment EF drawn parallel to AB cuts AD in F and BC in E such that $\dfrac{BE}{EC} = \dfrac{3}{4}$.

Diagonal DB intersects EF at G. prove that &EF= 10AB.

A. 7

B. 9

C. 10

D. 11

Answer: D

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12. If $15\tan^2\theta + 4\sec^2\theta = 23,$ then find the value of $(\sec\theta + \cosec\ \theta)^2 - \sin^2\theta.$

A. $\dfrac{13}{\sqrt{12}}$

B. $\dfrac{13}{2}$

C. $\dfrac{15}{2}$

D. $\dfrac{15}{\sqrt{2}}$

Answer: C

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13. If the median for the following frequency distribution is 28.5, then find the values of x and y respectively.

Classes	Frequency
0 – 10	5
10 – 20	x
20 – 30	20
30 – 40	15
40 – 50	y
50 – 60	5
Total	60

A. 8, 7

B. 7, 8

C. 9, 6

D. 6, 9

Answer: A

14. What should be added in the polynomial $x^3 - 6x^2 + 11x + 8$ so that it is completely divisible by $x^2 - 3x + 2$?

A. 2

B. -2

C. 14

D. -14

Answer: D

15.   Evaluate

$$\left[4\left(\sin^2 30° + \cos^4 60°\right) - 3\left(\cos^2 45° - \sin^2 90°\right)\right] \times \frac{2\cos^2 60° + 3\sec^2 30}{\sin^2 30° + c}$$

A. $\dfrac{55}{6}$

B. O

C. 1

D. $\dfrac{32}{3}$

Answer: A

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16. O is the centre of a circle of radius $5cm$. T is a point such that $OT = 13cm$ and OT intersects the circle at E. If AB is the tangent to the circle at E, find length of AB.

A. $6\dfrac{2}{5}$ cm

B. $6\dfrac{2}{3}$ cm

C. $6\dfrac{2}{9}$ cm

D. $3\dfrac{1}{3}$ cm

Answer: B

17. If the centroid of the triangle formed by the points A(a,b), B(b,c) and C(c,a) is at the origin, then what is the value of $\dfrac{a^2}{bc} + \dfrac{b^2}{ca} + \dfrac{c^2}{ab}$?

A. 0

B. $a + b + c$

C. 3

D. $a^3 + b^3 + c^3$

Answer: C

18. The positive value of k for which the equation $x^2 + kx + 64 = 0$ and $x^2 - 8x + k = 0$ will both have real roots, is 4 (b) 8 (c) 12 (d) 16

A. 16

B. -16

C. 12

D. -12

Answer: A

19. A solid metallic right circular cone 20 cm high and whose vertical angle is 60°, is cut into two parts at the middle of its height by a plane parallel to its base. If the frustum so obtained be drawn into a wire of diameter 1/12 cm, find the length of the wire.

A. 2440 m

B. 2560 m

C. 4480 m

D. 3280 m

Answer: C

20. Which of the following statements is CORRECT?

A. A tangent to a circle is perpendicular to the radius through the

point of contact.

B. A line which intersects a circle in two distinct points is called a

secant of the circle.

C. The lengths of the two tangents drawn from an external point to a

circle are equal.

D. All of these

Answer: D

1. Amita, Suneha and Raghav start preparing cardsfor all the persons of an old age home. In order to complete one card, they take 10, 16 and 20 minutes respectively. If all of them started together, after what time will they start preparing a new card together?

    A. 40 minutes

    B. 50 minutes

    C. 60 minutes

    D. 80 minutes

Answer: D

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2. Mohit and Rohit each have certain number of oranges. Mohit says to Rohit, "if you give me 10 of your oranges, I will have twice the number of

oranges left with you". Rohit replies, "if you give me 10 of your oranges, I will have the same number of oranges as left with you." Find the number of oranges with Mohit and Rohit respectively.

A. 50, 70

B. 70, 50

C. 60, 60

D. 80, 40

Answer: B

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3. A shopkeeper sold an air-conditioner for Rs. 25935 with a discount of 9% and earned a profit of 3.74%. What would have been the percentage of profit if no discount were offered? 12. 3% b. 16% c. $15. 6\%$ d. none of these

A. 12.3%

B. 15.6 %

C. 16 %

D. None of these

Answer: D

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4. Raghav buys a shop of Rs. 1,20,000. He pays half of the amount in cash and agrees to pay the balance in 12 annual instalments of Rs. 5000 each. If the rate of interest is 12% and the pays with the instalment the interest due on the unpaid amount, find the total cost of the shop.

A. Rs. 1,60,800

B. Rs. 1,66,800

C. Rs. 1,68,800

D. Rs. 1,60,000

Answer: B

5. A shopkeeper buys a number of books for Rs 80. If the had bought 4 more books for the same amount, each book would have cost Rs 1 less. How many books did he buy?

A. 16

B. 20

C. 18

D. 22

Answer: A

6. There is a small island in the middle of a 100 m wide river and a tall tree stands on the island. P and Q are points directly opposite to each other on two banks and in line with the tree. If the angles of elevation of the top of the tree from P and Q are respectively $30°$ and $45°$ find the height of the tree

A. 35.3 m

B. 35.6 cm

C. 35 m

D. 36.60 m

Answer: D

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7. A child has a block in the shape of a cube with one letter written on each face as shown here:

U	Q	T	R	I	P

The cube is thrown once. What is the probability of getting a vowel?

A. $5/6$

B. 1

C. $1/3$

D. $1/6$

Answer: C

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8. The short and long hands of a clock are 4cm and 6cm long respectively. Find the sum of distances travelled by their tips in 2 days. $\left(Take \pi \dfrac{22}{7} \right)$

A. 1901.85 cm

B. 1940.85 cm

C. 1910.85 cm

D. 1900 cm

Answer: C

9. A circus tent is cylindrical upto a height of 3m and conical above it. If the diameter of the base is 105m and the slant height of the conical part is 53m, find the total canvas used in making the tent.

A. $9735 \ m^2$

B. $9755 \ m^2$

C. $9753 \ m^2$

D. $9537 \ m^2$

Answer: A

10. A girl of height 90 cm is walking away from the base of a lamp-post at a speed of 1.2 m/s. If the lamp is 3.6 m above the ground, find the length of her shadow after 4 seconds.

A. 0.6 m

B. 2.6 m

C. 1.4 m

D. 1.6 m

Answer: D

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Achievers Section

1. Match the following.

    Column-I

P.   If points (k, 3), (6, -2) and (-3, 4) are collinear, then the value of k is

Q.   If the points A(7,-2), B(5, 1) and C(3, 2k) are collinear, then the valu

R.   If the point P(m, 3) lies on the line segment joining the points $A\left(-\right.$

S.   The value of a for which the area of the triangle formed by the points

A. $(P) \rightarrow (iv), (Q) \rightarrow (iii), (R) \rightarrow (i), (S) \rightarrow (ii)$

B. $(P) \rightarrow (i), (Q) \rightarrow (iv), (R) \rightarrow (iii), (S) \rightarrow (ii)$

C. $(P) \rightarrow (i), (Q) \rightarrow (iv), (R) \rightarrow (ii), (S) \rightarrow (iii)$

D. $(P) \rightarrow (iv), (Q) \rightarrow (iii), (R) \rightarrow (ii), (S) \rightarrow (i)$

Answer: A

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2. State 'T' for true and 'F' for false and select the correct option.

I. If a quadratic polynomial f(x) is a square of a linear polynomial, then its

two zeroes are coincident.

II. If a quadratic polynomial f(x) is not factorisable into linear factors, then

it has no real zero.

III. If graph of quadratic polynomial $ax^2 + bx + c$ cuts positive direction of y-axis, then the sign of c is positive.

If fourth degree polynomial is divided by a quadratic polynomial, then the degree of the remainder is 2.

A.
I	II	III	IV
F	F	T	T

B.
I	II	III	IV
T	T	T	F

C.
I	II	III	IV
F	T	T	F

D.
I	II	III	IV
T	T	T	T

Answer: B

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3. V_1, V_2, V_3 and V_4 are the volumes of four cubes of side lengths x cm, 2x cm, 3x cm and 4x cm respectively. Some statements regarding these volumes are shown here

(1) $V_1 + V_2 + 2V_3 < V_4$

(2) $V_1 + 4V_2 + V_3 < V_4$

(3) $2(V_1 + V_3) + V_2 = V_4$

Which of the given statements is CORRECT ?

A. (1) and (2) only

B. (2) and (3) only

C. (1) and (3) only

D. (1), (2) and (3)

Answer: D

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4. TF is a tower with F on the ground. The angle of elevation of T from A is xo such that $\tan xo = \dfrac{2}{5}$ and $AF = 200m$. The angle of elevation of T from a nearer point B is yo with $BF = 80m$. The value of yo is $75o$

(b) $45o$ (c) $60o$ (d) $30o$

A. Both Statement I and Statement II are true.

B. Statement I is true but Statement II is false.

C. Statement I is false but Statement II is true.

D. Both Statement I and Statement II are false.

Answer: B

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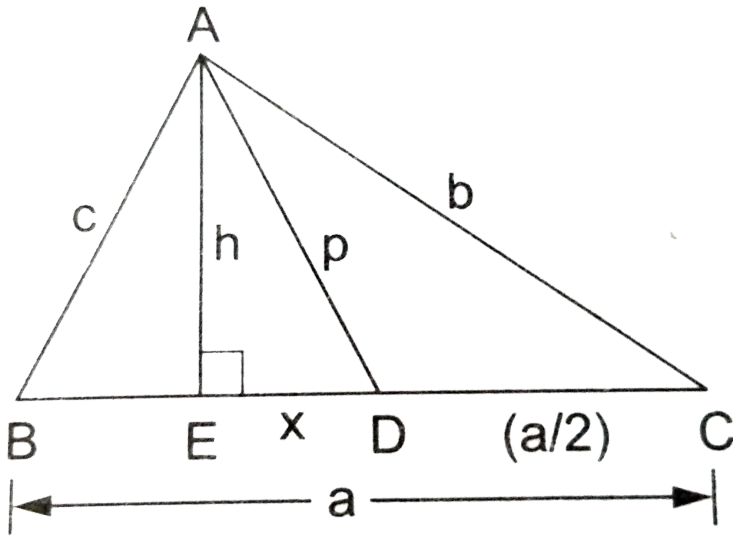**5.** In the given figure, D is the midpoint of side BC and $AE \perp BC$. If

$BC = a$, $AC = b$, $AB = c$, $ED = x$ $AD = p$ and $AE = h$ prove that

(i) $b^2 = p^2 + ax + \dfrac{a^2}{4}$

(ii) $c^2 = p^2 - ax + \dfrac{a^2}{4}$

(iii) $\left(b^2 + c^2\right) = 2p^2 + \dfrac{1}{2}a^2$

$(iv) \left(b^2 - c^2\right) = 2ax.$

A.
P	Q	R
$a^2 x$	$a^2/2$	$2p^2$

B.
P	Q	R
ax	$a^2/4$	$4p^2$

C.
P	Q	R
ax	$a^2/4$	$2p^2$

D.
P	Q	R
$a^2 x$	$a^2/2$	$2p$

Answer: C

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