



MATHS

BOOKS - HT Olympiad Previous Year Paper

IMO QUESTION PAPER 2016 SET B

Mathematical Reasoning

1. If $\sin \theta + \cos \theta = a$, then find the value of $\sin^6 \theta + \cos^6 \theta$.

A. $\frac{3 - 4(a^2 + 1)^2}{4}$

B. $\frac{4 - 3(a^2 - 1)^2}{4}$

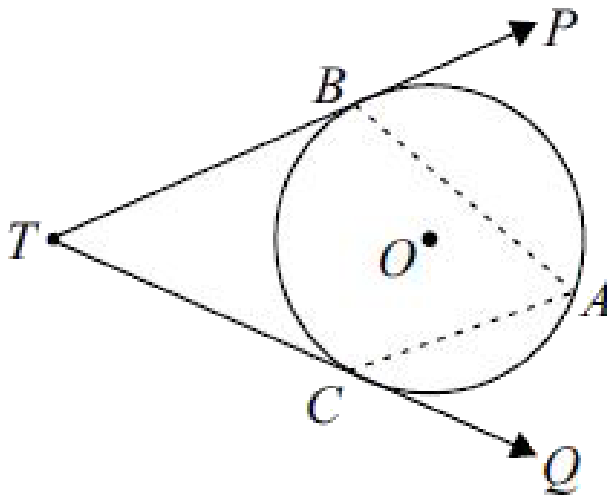
C. $\frac{4 - 3(a^2 + 1)^2}{4}$

D. $\frac{3 - 4(a^2 - 1)^2}{4}$

Answer: B



2. In the given figure, TBP and TCQ are tangents to the circle, whose centre is O . Also, $\angle PBA = 60^\circ$ and $\angle ACQ = 70^\circ$. Find $\angle BAC$ and $\angle BTC$.



- A. $45^\circ, 60^\circ$
- B. $80^\circ, 30^\circ$
- C. $60^\circ, 90^\circ$
- D. $50^\circ, 80^\circ$

Answer: D



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3. The hypotenuse of a right triangle is 25 cm. The difference between the lengths of the other two sides of the triangle is 5 cm. Find the lengths of these sides.

A. 15 cm, 20 cm

B. 20 cm, 25 cm

C. 10 cm, 15 cm

D. 5 cm, 10 cm

Answer: A



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4. Three positive integers a_1, a_2, a_3 are in A.P. , such that $a_1 + a_2 + a_3 = 33$ and $a_1 \times a_2 \times a_3 = 1155$. Find the integers a_1, a_2, a_3 .

A. 15, 20, 17

B. 10, 11, 12

C. 7, 11, 15

D. 7, 15, 20

Answer: C



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5. Which of the following is a rational number?

A. Sum of $(2 + \sqrt{3})$ and its reciprocal

B. Square root of 18

C. Square root of $7 + 4\sqrt{3}$

D. None of these

Answer: A

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6. In a cyclic quadrilateral ABCD, $\angle A = (x + 2)^\circ$, $\angle B = (y + 3)^\circ$, $\angle C = (3y + 8)^\circ$ and $\angle D = (4x - 8)^\circ$. Find the smallest and the largest angle.

A. 48° , 143°

B. 37° , 132°

C. 37° , 143°

D. 20° , 132°

Answer: C

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7. Area of a triangle whose sides are 18 cm, 24 cm and 30 cm is $36k \text{ cm}^2$.

Find the value of k.

A. 8

B. 4

C. 6

D. 10

Answer: C



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8. A child's game has 8 triangle of which 3 are blue and rest are red, and 10 square of which 6 are blue and rest are red. One piece is lost at random. Find the probability that it is a

(i) trinagle (ii) square

(iii) square of blue colour

(iv) triangle of red colour

A. $\begin{matrix} (i) & (ii) \\ 5/18 & 1/9 \end{matrix}$

B. $\begin{matrix} (i) & (ii) \\ 4/9 & 5/9 \end{matrix}$

C. $\begin{matrix} (i) & (ii) \\ 6/9 & 4/9 \end{matrix}$

D. $\begin{matrix} (i) & (ii) \\ 5/18 & 1/3 \end{matrix}$

Answer: D



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9. On dividing $6x^3 + 8x^2 - 3x + 8$ by a polynomial $g(x)$, the quotient and remainder were $3x + 4$ and $6x + 20$, respectively. Find $g(x)$

A. $2x - 3$

B. $2x^2 + 4$

C. $3x^2 - 4$

D. $2x^2 - 3$

Answer: D



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10. If P ($9a-2,-b$) divides line segment joining A ($3a+1,-3$) and B($8a,5$) in the ratio 3: 1, then find the values of a and b.

A. $-1, -3$

B. $-3, 1$

C. $1, -3$

D. $1, 3$

Answer: C



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11. Find the mean, mode and median of the following data.

x_i	58	59	60	61	62	63	64	65	66
f_i	2	3	6	15	10	5	4	3	2

A. 60.72, 61, 61

B. 60.72, 62, 61

C. 61.72, 61, 62

D. 61.72, 61, 61

Answer: D



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12. Select the INCORRECT match.

A. $\cos^2 \theta + \frac{1}{1 + \cot^2 \theta} = 1$

B. $(1 + \tan^2 \theta)(1 + \sin \theta)(1 - \sin \theta) = 1$

C. $\frac{\tan \theta + \sin \theta}{\tan \theta - \sin \theta} = \frac{\sec \theta - 1}{\sec \theta + 1}$

D. $\frac{\sin^3 \theta + \cos^3 \theta}{\sin \theta + \cos \theta} + \sin \theta \cos \theta = 1$

Answer: C



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13. Equilateral triangles are drawn on the sides of a right triangle, then the area of the triangle on the hypotenuse is equal to _____ of the areas of the triangles on the other two sides.

- A. Product
- B. Sum
- C. Difference
- D. None of these

Answer: B



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14. Which of the following system of equations has no solution?

A. $3x - y = 2, 9x - 3y = 6$

B. $4x - 7y + 28 = 0, 5y - 7x + 9 = 0$

C. $3x - 5y - 11 = 0, 6x - 10y - 7 = 0$

D. None of these

Answer: C



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15. An elastic belt is placed round the rim of a pulley of radius 5cm. One point on the belt is pulled directly away from the centre O of the pulley until it is at P , 10cm from O . Find the length of the belt that is in contact with the rim of the pulley. Also, find the shaded area.

A. $\frac{\pi}{20} cm, \frac{3}{25} cm(3 - \sqrt{3} - \pi) cm^2$

B. $\frac{25\pi}{3} cm, \frac{1}{3} (3\sqrt{3} - \pi) cm^2$

C. $\frac{\pi}{3} \text{ cm}, \frac{25}{3} (2\sqrt{3} - \pi) \text{ cm}^2$

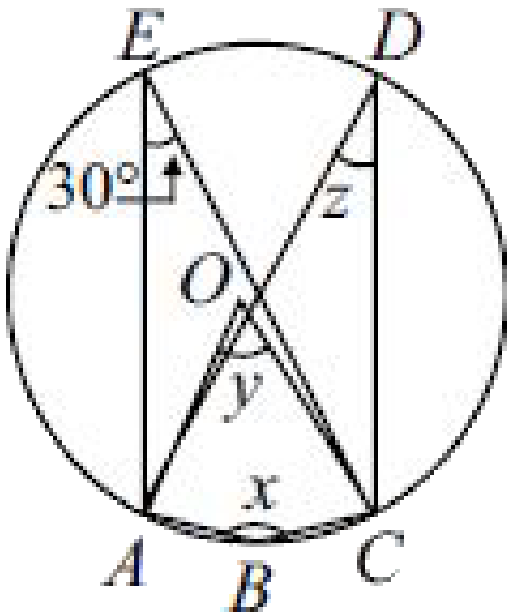
D. $\frac{20\pi}{3} \text{ cm}, \frac{25}{3} (3\sqrt{3} - \pi) \text{ cm}^2$

Answer: D

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16. In the given figure, O is the centre of the circle. Find the value of

$$\frac{x - y - z}{20^\circ}$$



A. 1

B. 2

C. 3

D. 4

Answer: C



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17. $PQRST$ is a regular pentagon and bisector of $\angle TPQ$ meets SR at L . If bisector of $\angle SRQ$ meets PL at M , find $\angle RML$.

A. 36°

B. 38°

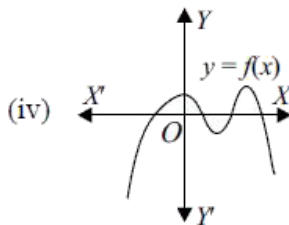
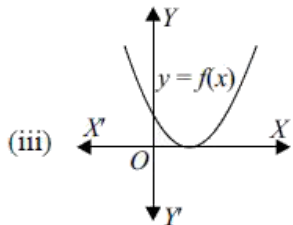
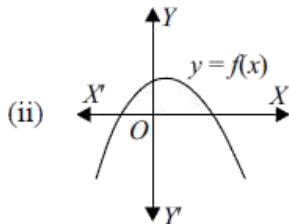
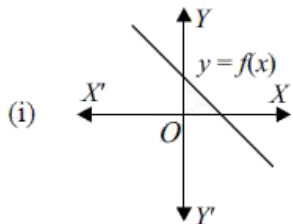
C. 26°

D. 28°

Answer: A



18. Find the number of zeroes of $f(x)$, in each case.



- A. (i) (ii) (iii) (iv)
1 2 1 4
- B. (i) (ii) (iii) (iv)
1 2 4 1
- C. (i) (ii) (iii) (iv)
4 2 1 4
- D. (i) (ii) (iii) (iv)
1 2 3 4

Answer: A



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19. If roots of the equation $(a^2 + b^2)x^2 - 2(ac + bd)x + (c^2 + d^2) = 0$ are equal, then $bc - ad =$

- A. 1
- B. 0
- C. -1
- D. 2

Answer: B



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20. The line segment joining the midpoints of the diagonals of a trapezium are parallel to each of the parallel sides and is equal to _____ the difference of these sides,

A. $\frac{1}{2}$

B. $\frac{2}{3}$

C. $\frac{1}{4}$

D. $\frac{3}{4}$

Answer: A



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Everyday Mathematics

1. The cash difference between the selling prices of an article at a profit of 4% and 6% is ₹ 3. The ratio of the two selling prices is

A. 51 : 52

B. 52 : 53

C. 51 : 53

D. 51 : 55

Answer: B



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2. A certain number of tennis balls were purchased for 450. Five more balls could have been purchased for the same amount if each ball was cheaper by 15. Find the number of balls purchased.

A. 10

B. 15

C. 20

D. 25

Answer: A



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3. Two tanks are of the same capacity. The dimensions of the first tank are $12\text{cm} \times 8\text{cm} \times 4\text{cm}$. The second tank has a square base with depth 6 cm, then find the side of the square.

A. 12 cm

B. 6 cm

C. 8 cm

D. 10 cm

Answer: C



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4. The average age of a husband and his wife was 23 years at the time of their marriage. After five years they have a one year old child. The average age of the family now is:

A. 19 years

B. 23 years

C. 28.5 years

D. 29.3 years

Answer: A



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5. Aashutosh covers a certain distance between his home and college by cycle. Having an average speed of 30 km/h, he is late by 20 min. However, with a speed of 40 km/h, he reaches his college 10 min earlier. Find the distance between his house and college.

A. 50 km

B. 60 km

C. 30 km

D. 55 km

Answer: B



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6. Madan pays income tax at the rate of 10%. If his income is increased by 10% and his tax rate increases to 15%, then his net income after paying tax would increase by ₹ 350. What is Madan's income?

A. ₹ 8,000

B. ₹ 10,000

C. ₹ 12,000

D. ₹ 14,000

Answer: B



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7. Four milkmen rented a pasture. A grazed 24 cows for 3 months, B grazed 10 cows for 5 months, C grazed 35 cows for 4 months and D grazed 21 cows for 3 months. If A's share of rent is ₹ 720, find the total rent of the field.

A. ₹ 4280

B. ₹ 2240

C. ₹ 3250

D. ₹ 3500

Answer: C



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8. Sneh's age is $\frac{1}{6}$ th of her father's age. Sneh's father's age will be twice of Vimal's age after 10 years. If Vimal's eighth birthday was celebrated two years before then what is Sneh's present age?

A. $6\frac{2}{3}$ years

B. 24 years

C. 30 years

D. None of these

Answer: D



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9. Gold is 19 times as heavy as water and copper is 9 times as heavy as water. In what ratio should these be mixed to get an alloy 15 times as heavy as water ?

A. 1 : 1

B. 3 : 1

C. 1 : 2

D. 3 : 2

Answer: D



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10. Amit gets pocket money from his father every day. Out of the pocket money, he saves ₹ 2.75 on first day and on each succeeding day he increases his saving by 25 paise. Find the amount saved by Amit on 14th day.

- A. ₹ 6
- B. ₹ 12
- C. ₹ 8
- D. ₹ 10

Answer: A



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1. A manufacture of TV set produced 600 sets in the third year and 700 sets in the seventh year. Assuming that the production increases uniformly by a fixed number every year, find:

- (i) the production in the first year
- (ii) the production in the 10th year.
- (iii) the total production in first 7 years.

- | | | | |
|----|-----------|-----------|------------|
| | (i) | (ii) | (iii) |
| A. | 500 units | 600 units | 5000 units |
| | (i) | (ii) | (iii) |
| B. | 475 units | 800 units | 4500 units |
| | (i) | (ii) | (iii) |
| C. | 550 units | 775 units | 4375 units |
| | (i) | (ii) | (iii) |
| D. | 600 units | 800 units | 6000 units |

Answer: C



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2. (i) Area enclosed by two concentric circles with radius R and r respectively such that $R > r$ is $\pi(R^2 - r^2)$.

(ii) The lengths of tangents drawn from an external point to a circle are not equal.

(iii) There is one and only one tangent at any point on the circumference of a circle.

(iv) Ratio of the area of the sector of a circle with central angle 90° to the area of that circle is $1 : 4$.

A. (i) (ii) (iii) (iv)
 F F F F

B. (i) (ii) (iii) (iv)
 F T F F

C. (i) (ii) (iii) (iv)
 T F T T

D. (i) (ii) (iii) (iv)
 T T T T

Answer: C



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3. Which of the following options hold?

Statement I : The equation $\sqrt{3}x^2 - 2\sqrt{2}x - 2\sqrt{3} = 0$ has real and equal roots.

Statement II : If the difference between the roots of the quadratic equation $x^2 + kx + 12 = 0$ is 1, then the value of k is 6.

- 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: D

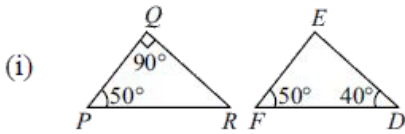


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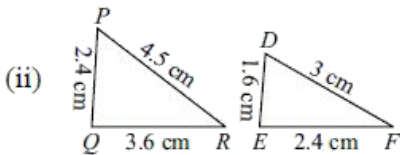
4. Match the following columns.

Column-I

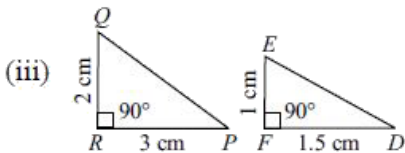
Column-II



(P) $\frac{\text{ar } \Delta PQR}{\text{ar } \Delta DEF} = \frac{9}{4}$



(Q) $\frac{\text{ar } \Delta PQR}{\text{ar } \Delta DEF} = 4$



(R) $\Delta PQR \sim \Delta FED$

A. (i) - (R), (ii) - (Q), (iii) - (P)

B. (i) - (R), (ii) - (P), (iii) - (Q)

C. (i) - (P), (ii) - (Q), (iii) - (R)

D. (i) - (Q), (ii) - (P), (iii) - (R)

Answer: B

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5. If a pair of linear equations $a_1x + b_1y + c_1 = 0$ and

$a_2x + b_2y + c_2 = 0$, then

(i) $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$ implies The pair of linear equations is P

(ii) $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$ implies The pair of linear equations is Q

(iii) $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$ implies The pair of linear equations is R

- | | | | |
|----|--------------|--------------|--------------|
| | P | Q | R |
| A. | Inconsistent | Consistent | Consistent |
| | P | Q | R |
| B. | Inconsistent | Inconsistent | Consistent |
| | P | Q | R |
| C. | Inconsistent | Inconsistent | Inconsistent |
| | P | Q | R |
| D. | Inconsistent | Consistent | Inconsistent |

Answer: A



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