

## MATHS

### BOOKS - HT Olympiad Previous Year Paper

### IMO QUESTION PAPER 2018 SET B

#### Mathematical Reasoning

1. Heights of students of class X are given in the following distribution:

Heights (in cm)	150-155	155-160	160-165	165-170	170-175
Number of students	13	10	20	10	7

Find the modal height.

A. 150 cm

B. 170 cm

C. 162.5 cm

D. None of these

**Answer: C**



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2. If  $\alpha, \beta$  and  $\gamma$  are the zeroes of the polynomial

$f(x) = ax^3 + bx^2 + cx + d$ , then  $\frac{1}{\alpha} + \frac{1}{\beta} + \frac{1}{\gamma} =$

A.  $-\frac{d}{b}$

B.  $\frac{c}{d}$

C.  $-\frac{c}{d}$

D.  $-\frac{c}{a}$

**Answer: C**



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3. Which of the following is INCORRECT?

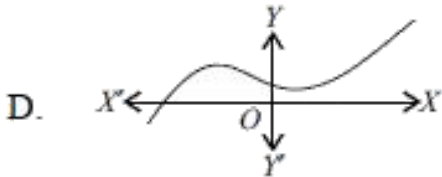
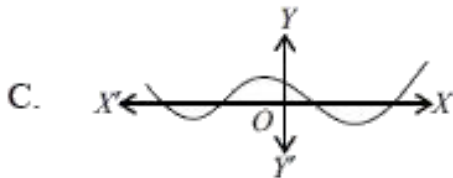
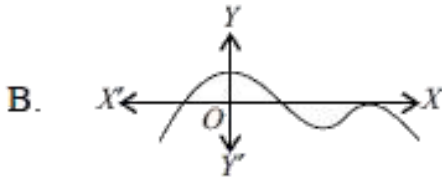
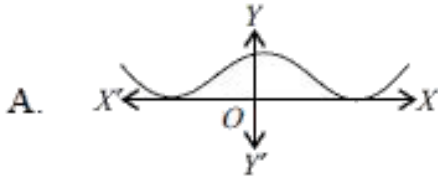
- A. If  $x$  is a rational number, such that the prime factorisation of denominator is not in the form  $2^n 5^m$ , (where  $m$  and  $n$  are non-negative integers), then it has a decimal expansion which is non-terminating and repeating.
- B.  $5 + \sqrt{2}$  is an irrational number.
- C. Every composite number can be expressed as a product of primes.
- D. None of these

**Answer: D**



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4. Which of the following graphs has more than three distinct real roots?



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5. If  $2x - 3y = 7$  and  $(a + b)x - (a + b - 3)y = 4a + b$  represent coincident lines, then  $a$  and  $b$  satisfy the equation

A.  $a + 5b = 0$

B.  $5a + b = 0$

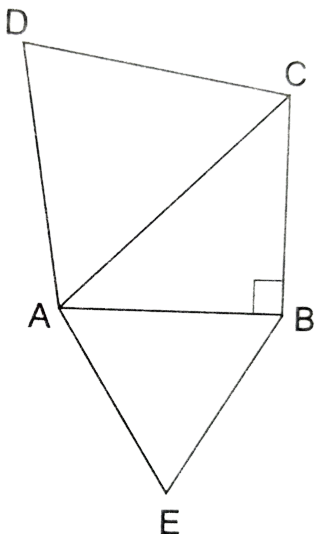
C.  $a - 5b = 0$

D.  $5a - b = 0$

**Answer: C**

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6.  $\triangle ABC$  is an isosceles triangle, right-angled at  $B$ . Similar triangles  $ACD$  and  $ABE$  are constructed on sides  $AC$  and  $AB$ . Find ratio between the areas of  $\triangle ABC$  and  $\triangle ACD$ .



A. 3:2

B. 2:3

C.  $\sqrt{2}:1$

D. 1:2

**Answer: D**



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7. The points  $(x, y)$ ,  $(x_1, y_1)$  and  $(x - x_1, y - y_1)$  are collinear, if

A.  $xy_1 = x_1y$

B.  $xy = x_1y_1$

C.  $xx_1 = yy_1$

D.  $x + x_1 = y + y_1$

**Answer: A**



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8. If  $x \neq y$  and the sequences  $x, a_1, a_2, y$  and  $x, b_1, b_2, y$  each are in A.P.,

then  $\left(\frac{a_2 - a_1}{b_2 - b_1}\right)$  is

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

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

C. 1

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

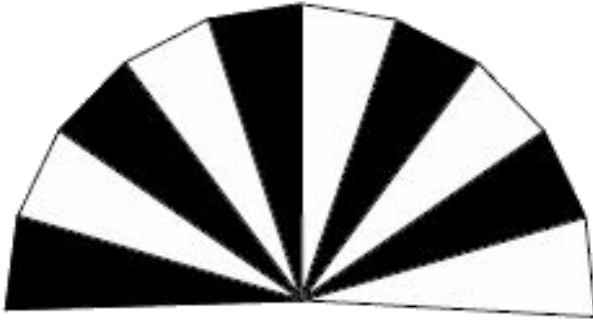
**Answer: C**



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9. A hand fan is made by stitching 10 equal sized triangular strips of two different coloured papers as shown. The dimensions of equal strips are 13 cm, 13 cm and 24 cm. Find the area of white coloured paper needed to

make the hand fan.



- A.  $220 \text{ cm}^2$
- B.  $150 \text{ cm}^2$
- C.  $600 \text{ cm}^2$
- D.  $300 \text{ cm}^2$

**Answer: D**



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**10.** In figure arcs are drawn by taking vertices A, B and C of an equilateral triangle of side 10 cm , To intersect the sides BC, CA and AB at their respective mid- points D, E and F. Find the area of the shaded region. (use



$$\pi = 3.14)$$



A.  $39.25 \text{ cm}^2$

B.  $82.52 \text{ cm}^2$

C.  $42.20 \text{ cm}^2$

D. None of these

**Answer: A**



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**11.** A jar contains 54 marbles each of which is blue, green or white. The probability of selecting a blue marble at random from the jar is  $\frac{1}{3}$ , and the probability of selecting a green marble at random is  $\frac{4}{9}$ . How many white marbles does the jar contain?

A. 12

B. 6

C. 9

D. 11

**Answer: A**



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12.

Evaluate:

$$\frac{\sec 39^\circ}{\cos ec 51^\circ} + \frac{2}{\sqrt{3}} \tan 17^\circ \tan 38^\circ \tan 60^\circ \tan 52^\circ \tan 73^\circ - 3(\sin^2 31^\circ + \sin^2 59^\circ)$$

A. 0

B. 1

C.  $\sin 45^\circ$

D.  $\cos 30^\circ$

**Answer: A**



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13. A reservoir in the form of the frustum of a right circular cone contains  $44 \times 10^7$  litres of water which fills it completely. The radii of the bottom and top of the reservoir are 50 metres and 100 metres respectively. Find the depth of water and the lateral surface area of the reservoir. (Take  $\pi = 22/7$ )

A.  $32150.2 \text{ m}^2$

B.  $172.64.2 \text{ m}^2$

C.  $26146.23 \text{ m}^2$

D. None of these

**Answer: C**



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14. 2 is a root of the equation  $x^2 + bx + 12 = 0$ . If equation  $x^2 + bx + q = 0$  has equal roots, then  $q =$

A. 8

B.  $-8$

C. 16

D.  $-16$

**Answer: C**



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**15.** Five coins were simultaneously tossed 1000 times and at each toss the number of heads were observed. The number of tosses during which 0,1,2,3,4 and 5 heads were obtained are shown in the table below. Find the mean number of heads per toss.

A. 5.92

B. 1.28

C. 2.47

D. 4.23

**Answer: C**

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**16.** The co-ordinates of the third vertex of an equilateral triangle whose two vertices are at  $(3, 4)$ ,  $(-2, 3)$  are

A.  $(1, 7)$

B.  $(5, 1)$

C.  $\left(\frac{1 + \sqrt{3}}{2}, \frac{7 - 5\sqrt{3}}{2}\right)$  or  $\left(\frac{1 - \sqrt{3}}{2}, \frac{7 + 5\sqrt{3}}{2}\right)$

D.  $(-5, 5)$

**Answer: C**

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**17.** Determine the height of a mountain if the elevation of its top at an unknown distance from the base is  $30^\circ$  and at a distance 10km further off

from the mountain, along the same line, the angle of elevation is  $15^\circ$ .

(Use  $\tan 15^\circ = 0.27$ )

A. 9.76 km

B. 5.07 km

C. 4.90 km

D. 8.02 km

**Answer: B**



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**18.** Find the value of  $k$ , for which the polynomial  $p(x) = x^{100} + 2x^{99} + k$  is exactly divisible by  $(x+1)$ .

A. 1

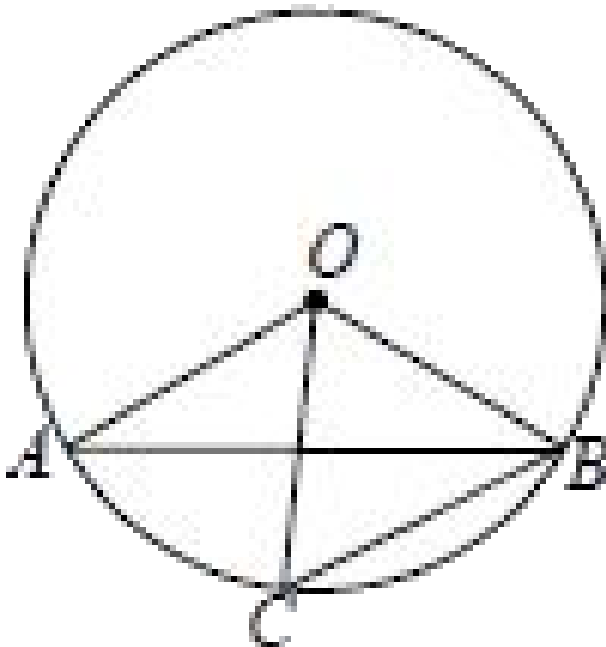
B. 0

C. -1

Answer: A

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19. In the given figure (not drawn to scale),  $O$  is the centre of the circle,  $\angle OAB = 30^\circ$  and  $\angle OCB = 55^\circ$ . Find  $\angle BOC$  and  $\angle AOC$  respectively.



A.  $50^\circ$ ,  $30^\circ$

B.  $70^\circ$ ,  $50^\circ$

C.  $120^\circ$ ,  $50^\circ$

D.  $70^\circ$ ,  $30^\circ$

**Answer: B**



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**20.** The following table shows the life time of 300 lamps.

Life time (in hours)	100-200	200-300	300-400	400-500	500-600	600-700	700-800
Number of lamps	38	12	48	42	43	65	52

A lamp is selected at random. Find the probability that the life time of the selected lamp is

(i) less than 300 hours



(ii) atleast 200 hours.

	(i)	(ii)
A.	$19/75$	$131/150$
B.	$131/150$	$15/6$
C.	$49/150$	$131/150$
D.	$1/6$	$131/150$



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## Everyday Mathematics

1. A can build a wall in 25 days and B can demolish the same wall in 80 days and C can build the same wall in 60 days. If they work on consecutive days one after another starting from A on the first day. Then, in how many days will the work be completed?

A. 67 days

B.  $67\frac{17}{24}$  days

C.  $66\frac{17}{24}$  days

D.  $68\frac{17}{24}$  days

**Answer: C**



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2. Price of a chair is greater than the price of a table by Rs. 400. If the price of 6 chairs and 6 tables is Rs. 4800, then by how much percent the price of a table is less than the price of a chair?

A.  $\frac{200}{3} \%$

B. 25 %

C.  $37\frac{1}{2} \%$

D.  $\frac{2}{3} \%$

**Answer: A**



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3. A student on his birthday distributed on an average 5 chocolates per student. If on the arrival of the teacher and the headmaster to whom the student gives 10 and 15 chocolates respectively, the average chocolate distributed per head increases to 5.5. How many students were in the class?

A. 28

B. 30

C. 32

D. 36

**Answer: A**

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4. Priyansh wants to plant 42 mango trees, 49 apple trees and 63 banana trees in equal rows. Also, he wants to make distinct rows of trees, i.e., only one type of tree in one row. Find the minimum of number rows required.

A. 22

B. 7

C. 17

D. 15

**Answer: A**



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5. A group consists of 15 males and 12 females. Write a quadratic polynomial whose roots are equal to the number of males and females .

A.  $x^2 - 27x + 180$

B.  $x^2 + 27x - 180$

C.  $x^2 + 3x - 27$

D. None of these

**Answer: A**

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6. A square water tank has its side equal to 40 m. There are four semi-circular grassy plots all round it. Find the cost of turfing the plot at Rs 1.25 per square metre (*Take*  $\pi = 3.14$ )

A. Rs. 2671

B. Rs. 4401

C. Rs. 2512

D. Rs. 3140

**Answer: D**

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7. A school decided to award prizes to the most punctual and disciplined students. The sum of two prizes is Rs.95 and their product is Rs. 2250. Calculate the prize money of the two prizes.

A. Rs. 50, Rs. 45

B. Rs. 60, Rs. 35

C. Rs. 70, Rs. 25

D. None of these

**Answer: A**



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8. A steamer goes down stream from one port to another in 4 h. It covers the same distance upstream in 5 h. If the speed of the stream is 2 km/h, then find the distance between the two ports.

A. 50 km

B. 60 km

C. 70 km

D. 80 km

**Answer: D**



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9. A girl calculates that the probability of her winning the first prize in a lottery is  $\frac{1}{30}$ . If 9000 tickets are sold, then how many tickets has she bought?

A. 300

B. 450

C. 900

D. 350

**Answer: A**



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10. The internal radius and thickness of a hollow metallic pipe are 24 cm and 1 cm respectively. If it is melted and recast into a solid cylinder of equal length, then find the diameter of the solid cylinder.

A. 7 cm

B. 14 cm

C. 96 cm

D. 98 cm

**Answer: B**



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## Achievers Section

1. Read the statements carefully and select the correct option.

Statement-I : The sum of first  $n$  terms of an A.P. whose first term is  $A$ , the second term is  $B$  and the last term is  $L$ , is equal to



$$\frac{(B + L - 2A)(A + L)}{2(B - A)}$$

Statement-II : If the sum of  $p$  terms of an A.P. is equal to the sum of its  $q$  terms, then the sum of its  $(p + q)$  terms is  $p + q$ .

- A. Both Statement-I and Statement-II are false.
- B. Both Statement-I and Statement-II are true.
- C. Statement-I is true but Statement-II is false.
- D. Statement-I is false but Statement-II is true.

**Answer: C**



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2. An iron pillar has some part in the form of a right circular cylinder and remaining in the form of a right circular cone. The radius of base of each of cone and cylinder is 8 cm. The cylindrical part is 240 cm high and the conical part is 36 cm high. Find

(i) The volume of iron used

(ii) The weight of pillar, if  $1 \text{ cm}^3$  of iron weighs 10 g.

	(i)	(ii)
A.	$50688 \text{ cm}^3$	826.65 kg
B.	$42652 \text{ cm}^3$	705.23 kg
C.	$50688 \text{ cm}^3$	506.88 kg
D.	None of these	



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3. Which of the following options is incorrect?

A. If the points are collinear, then the area of the triangle formed by the points is zero.

B. If the vertices of a  $\triangle ABC$  are  $(x, y)$ ,  $(x_1, 0)$  and  $(0, y_1)$ , such that

$$\frac{x}{x_1} + \frac{y}{y_1} = 1, \text{ then the three points are collinear.}$$

C. The distance between the points  $(6\cos 45^\circ, 0)$  and  $(0, 6\sin 45^\circ)$  is

1.

D. The coordinates of the centroid of triangle formed by the points

$$(x, y), (0, y_1) \text{ and } (x_1, 0) \text{ is } \left( \frac{x + x_1}{3}, \frac{y + y_1}{3} \right).$$

**Answer: C**



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4. If each of  $a, b$  and  $c$  is a positive acute angle such that  $\sin(a + b - c) = 1/2$ ,  $\cos(b + c - a) = 1/2$  and  $\tan(c + a - b) = 1$ , then find the values of  $a, b$  and  $c$  respectively.

A.  $30^\circ, 60^\circ, 90^\circ$

B.  $45^\circ, 45^\circ, 90^\circ$

C.  $30^\circ, 45^\circ, 60^\circ$

D.  $\left(37\frac{1}{2}\right)^\circ, 45^\circ, \left(52\frac{1}{2}\right)^\circ$

**Answer: D**



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5. Match the following and select the correct option.

**Column-I**

**Column-II**

- |   |                   |
|---|-------------------|
| (i) Probability that a leap year has 53 sundays is                        | (p) $\frac{1}{7}$ |
| (ii) If $P(A) = \frac{6}{7}$ , then $P(\text{not } A) =$                  | (q) $\frac{2}{7}$ |
| (iii) Probability of getting at most 2 heads in a throw of two coins is   | (r) $\frac{1}{2}$ |
| (iv) Probability of getting a red card from a pack of 52 playing cards is | (s) 1             |

A. (i)  $\rightarrow$  (q), (ii)  $\rightarrow$  (r), (iii)  $\rightarrow$  (p), (iv)  $\rightarrow$  (s)

B. (i)  $\rightarrow$  (q), (ii)  $\rightarrow$  (p), (iii)  $\rightarrow$  (s), (iv)  $\rightarrow$  (r)

C. (i)  $\rightarrow$  (s), (ii)  $\rightarrow$  (q), (iii)  $\rightarrow$  (p), (iv)  $\rightarrow$  (r)

D. (i)  $\rightarrow$  (p), (ii)  $\rightarrow$  (q), (iii)  $\rightarrow$  (s), (iv)  $\rightarrow$  (r)

**Answer: B**



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