MATHS

BOOKS - HT Olympiad Previous Year Paper

IMO QUESTION PAPER 2020 SET 1

Mathematical Reasoning

1. Determine the values of k for which the quadratic equation

$(k+4)x^2+(k+1)x+1=0$ has equal roots.

A. 5,2

B. $-3, 3$

C. 2,4

D. 5, -3

Answer: D

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2. Solve : $\frac{2}{\sqrt{x}} + \frac{3}{\sqrt{y}} = 2$ and $\frac{4}{\sqrt{x}} - \frac{9}{\sqrt{y}} = -1$

A. x = 1/2, y = 1/3

B. x = 4, y = 9

C. X = 4, y = 1/3

D. X = 2, y = 3

Answer: B

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3. The annual profits earned by 30 shops of a shopping complex in a locality give rise to the following distribution: Draw both ogives for the data above. Hence obtain the median profit.

A. 16.5

B. 15

C. 18.5

D. 17.5

Answer: D

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4. For what values of a is $2x^3 + ax^2 + 11x + a + 3$ exactly divisible by $(2x - 1)$?

A. 4

B. $\frac{8}{13}$

C. $-\frac{35}{13}$

D. -7

Answer: D

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5. If $\tan\theta = \frac{a}{b}$, then $\frac{a\sin\theta - b\cos\theta}{a\sin\theta + b\cos\theta}$ = ------.

A. $\frac{a^2 + b^2}{a^2 - b^2}$

B. $\frac{a^2 - b^2}{a^2 + b^2}$

C. $\frac{a + b}{a - b}$

D. $\frac{a - b}{a + b}$

Answer: B

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6. The perimeter of an isosceles triangle is 42 cm and its base is $1\frac{1}{2}$ times each of the equal sides. Find the area of triangle

A. $71.43cm^2$

B. $60.45cm^2$

C. $70.50cm^2$

D. $78.73cm^2$

Answer: A

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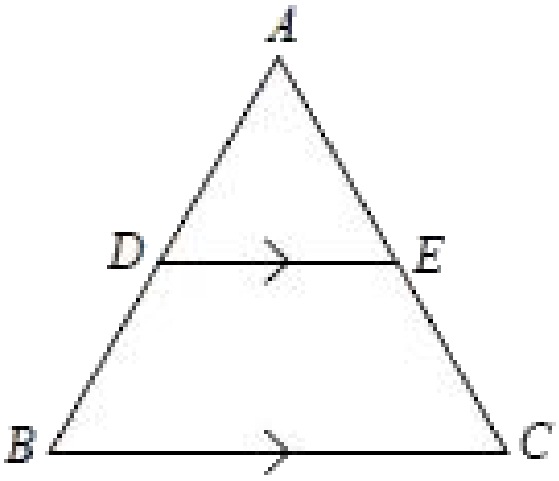
7. In the given figure, DE || BC and $\frac{ar(\Delta ADE)}{ar(\text{trapezium BDEC})} = \frac{4}{5}$

Find the value of DE : BC.



A. $2:3$

B. $4:5$

C. $3:2$

D. $4:9$

Answer: A

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8. Consider the following statements.

P. If the angles subtended by the two chords at the centre of a circle are equal, then the chords are equal.

Q. If two circles intersect at two points, then

the line through the centres is the perpendicular bisector of common chord.

Which of the following options is correct?

A. Only P is true

B. Only Q is true

C. Both P and Q are true

D. Neither P nor Q is true

Answer: C

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9. In a parallelogram ABCD, AB = 12 cm and the altitude corresponding to AB is 8 cm. If AD= 10 cm, then the altitude corresponding to AD is equal to

A. 9.2 cm

B. 4.8 cm

C. 9.6 cm

D. 4.2 cm

Answer: C

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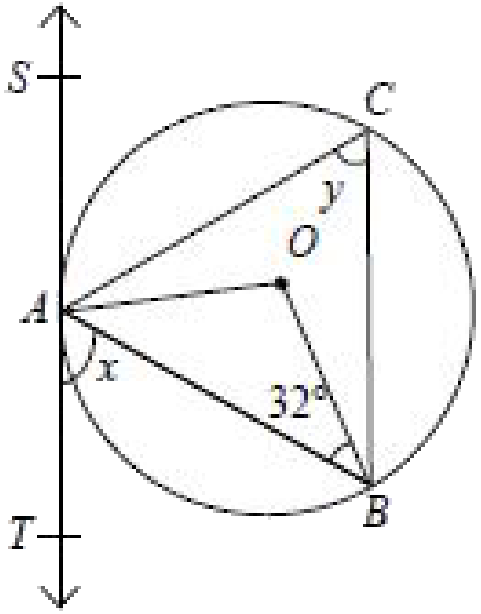
10. In the given figure, SAT is a tangent to the circle with centre 0, at a point A. If $\angle OBA = 32^\circ$, then find the values of x and y.



A. $52^\circ, 36^\circ$

B. $58^\circ, 58^\circ$

C. $32^\circ, 65^\circ$

D. $58^\circ, 60^\circ$

Answer: B

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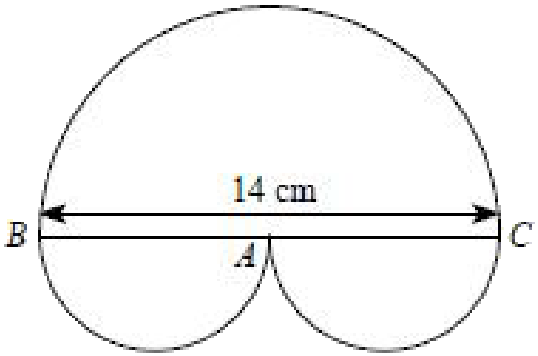
11. In the given figure, if A is the mid point of BC, then find the area of the whole figure.



A. $231cm^2$

B. $115.5cm^2$

C. $124cm^2$

D. $130cm^2$

Answer: B

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12. If $x = \frac{1}{3 - 2\sqrt{2}}$ and $y = \frac{1}{3 + 2\sqrt{2}}$, then find the value of x + y + xy.

A. 7

B. $4 + \sqrt{2}$

C. $3 + 4\sqrt{2}$

D. $4 - \sqrt{2}$B. 4+12

Answer: A

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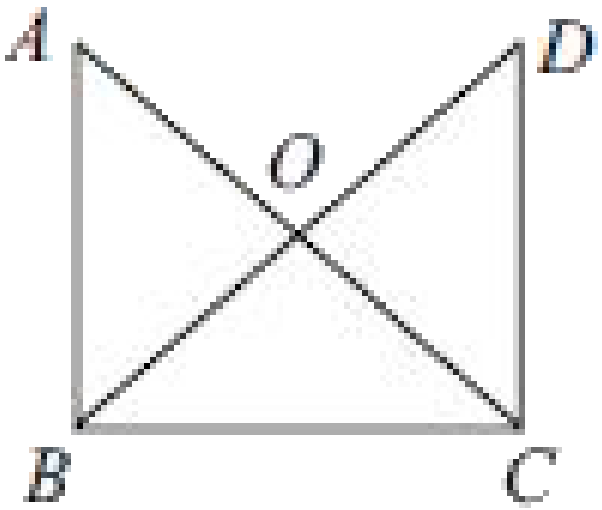
13. In the given figure, $\Delta ABC \sim \Delta DCB$, then

$AB \times DB =$



A. $OA \times OD$

B. $OB \times OC$

C. $AB \times DC$

D. $DC \times 4C$

Answer: D

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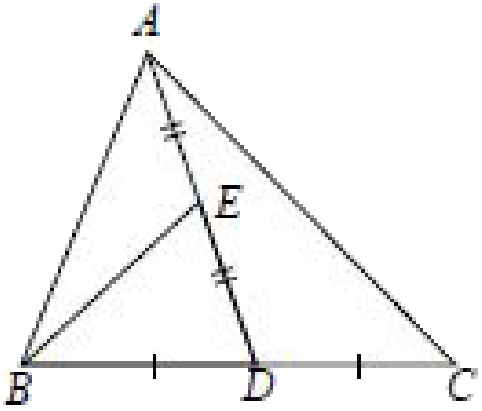
14. ABC is a triangle in which E is the mid point of AD. Then, ar(ΔBED) =



A. $\frac{1}{2}ar(\Delta ABC)$

B. $\frac{1}{4}ar(\Delta ABC)$

C. $\frac{3}{4}ar(\Delta ABC)$

D. $2ar(\Delta ABC)$

Answer: B

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15. There are 50 cards in a bag on which numbers from 1 to 50 are written. A card is taken out from the bag at random. Find the

probability of getting a card which is a perfect cube.

A. $\frac{2}{25}$

B. $\frac{3}{50}$

C. $\frac{7}{50}$

D. $\frac{1}{10}$

Answer: B

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16. If 2 is added to each of two given numbers, their ratio becomes 1 : 2. However, if 4 is subtracted from each of the given numbers, the ratio becomes 5 : 11. Find the numbers.

A. 35, 74

B. 34, 70

C. 28, 52

D. 30, 42

Answer: B

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17. A steel wire when bent in the form of a square encloses an area of $121\,cm^2$. If the same wire is bent in the form of a circle, find the area of the circle.

A. $44cm^2$

B. $308cm^2$

C. $77cm^2$

D. $154cm^2$

Answer: D

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18. A sphere of diameter 5 cm is dropped into a cylindrical vessel partly filled with water. The diameter of the base of the vessel is 10 cm. If the sphere is completely submerged, by how much will the level of water rise?

A. $\frac{4}{5}cm$

B. $\frac{3}{4}cm$

C. $\frac{5}{6}cm$

D. $\frac{1}{2}cm$

Answer: C

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19. If pt $\neq$ qs, then the pair of equations px + qy = r, sx + ty = u

A. has a unique solution

B. has no solution

C. has infinitely many solutions

D. Can't be determined

Answer: A

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20. The mid-point of the line segment joining A(2a, 4) and B(-2, 3b) is (1, 2a +1). Find the value of a and b.

A. 2,2

B. 2,3

C. 3,2

D. 5, 2

Answer: A

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Everyday Mathematics

1. The internal and external diameters of a hollow hemispherical vessel are 24cm and

25cm respectively. The cost to paint $1cm^2$ the surface is Rs. 0.05. Find the total cost to paint the vessel all over. $\left(use\pi = \frac{22}{7}\right)$

A. Rs.108.32

B. Rs.296.28

C. Rs.101.59

D. Rs.96.29

Answer: D

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2. The traffic lights at three different road crossings change after every 30 minutes, 45 minutes and 90 minutes respectively. If they all change simultaneously at 9:15 hours, then at what time will they again change simultaneously?

A. $9:45$ hrs

B. $10:15$ hrs

C. $10:45$ hrs

D. $10:35$ hrs

Answer: C

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3. The average age of 8 persons in a committee is increased by 2 years when two men aged 35 years and 45 years are substituted by two women. What is the average age of these two women ?

A. 28 years

B. 30 years

C. 42 years

D. 48 years

Answer: D

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4. A, B, C subscribe Rs. 50000 for a business. A subscribes Rs. 4000 more than B and B Rs. 5000 more than C. Out of a total profit of Rs. 35000, A receives: Rs. 8400 b. $Rs.11900$ c. $Rs.13600$ d. $Rs.14700$

A. Rs.8,400

B. Rs.11,900

C. Rs.13,600

D. Rs.14,700

Answer: D

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5. ₹ 6,500 were divided equally among a certain number of persons. Had there been 15

more persons, each would have got ₹ 30 less.

Find the original number of persons?

A. 50

B. 60

C. 45

D. 55

Answer: A

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6. A, B, C can do a work in 12, 8, 32 days respectively. They start working together but after 5 days A quit himself and B quit himself 4 days before the completion of the work. In how many days was the work completed?

A. $6\frac{4}{15}$ days

B. $6\frac{14}{15}$ days

C. $5\frac{4}{15}$ days

D. $5\frac{14}{15}$ days

Answer: B

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7. Two poles of height 9m and 14m stand on a plane ground. If the distance between their feet is 12m, find the distance between their tops.

A. 13 m

B. 12 m

C. 14 m

D. 15 m

Answer: A

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8. Two trains 200 m and 150 m long are running on parallel rails at the rate of 40 kmph and 45 kmph respectively. In how much time will they cross each other, if they are running in the same direction?

A. 72 secs

B. 132 secs

C. 192 secs

D. 252 secs

Answer: D

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9. The worth of a machine depreciates by 3% in first year, 5% in second year and 7% in third year. If current worth of machine is Rs.171399, then what was the worth 3 years ago?

A. Rs.7190000

B. Rs.196000

C. Rs.221000

D. Rs.200000

Answer: D

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10. A bag contains Rs.20, Rs. 10 and Rs.5 notes in the ratio 1:2:4. If their total value is Rs.3000, then the number of Rs.5 notes is

A. 50

B. 100

C. 150

D. 200

Answer: D

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Achievers Section

1. Select the incorrect option.

A. If the sides of two similar triangles are in the ratio 4:9, then the areas of these triangles are in the ratio 16: 81.

B. A vertical pole of length 12 m casts a shadow 8 m long on the ground and at the same time a tower casts a shadow 40 m long on the ground, the height of tower is 80 m.

C. In a right angled triangle, if hypotenuse is 20 cm and the ratio of other two sides is 3:4, then the other two sides are 12 cm and 16 cm.

D. All concentric circles are similar to each other.

Answer: B

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2. Solve the following questions.

(i) A vertical tower stands on a horizontal plane and is surmounted by a flagstaff of height 7 m. From a point on the ground, the angle of elevation of the bottom of the flagstaff is 30° and that of the top of the flagstaff is 45°. Find the height of the tower. (Use $\sqrt{3} = 1.732$)

(ii) The angle of elevation of an aeroplane from a point on the ground is 45°. After 15 seconds flight, the elevation changes to 30°. If the aeroplane is flying at a height of 3000 m,

then find the speed of the plane. (Use $\sqrt{3} = 1.732$)

A. (i) 8.62 m (ii) 101.6 m/sec

B. (i) 9.56 m (ii) 146.4 m/sec

C. (i) 9.24 m (ii) 138.4 m/sec

D. (i) 9.56 m (ii) 125.8 m/sec

Answer: B

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3. Fill in the blanks and select the correct option.

(i) The point on the y-axis which is equidistant from (-5, -2) and (3, 2) is_____.

(ii) The distance between the points (2, 4) and (-6,4) is _____ units.

(iii) The points (4,3), (7,-1) and (9,3) are the vertices of a/an _____triangle.

A. (i) (2,0), (ii) 8 , (iii) right angled

B. (i) (2,4) , (ii) 10, (iii) right angled

C. (i) (0, -2), (ii) 8, (iii) isosceles

D. (i) (0,-2) , (ii) 6 , (iii) equilateral

Answer: C

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4. Match the following and select the correct option.

	Column I		Column II
P.	$\frac{25}{441}$	(i)	Terminating decimal expansion
Q.	$\frac{129}{2^3 \times 5^4 \times 7^3}$	(ii)	Non-terminating non-repeating decimal expansion
R.	$\frac{543}{125}$		
S.	$\frac{13}{280}$		

A. $P \to (i), Q \to (i), R \to (ii), S \to (ii)$

B. $P \to (ii), Q \to (ii), R \to (i), S \to (ii)$

C. $P \to (i), Q \to (ii), R \to (i), S \to (ii)$

D. $P \to (ii), Q \to (i), R \to (ii), S \to (i)$

Answer: B

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5. Read the statements carefully and sate T for true and F for false.

(i) There are 1500 spherical lead shots each 4.2 cm in diameter can be obtained from a rectangular solid of lead with dimensions 66 cm, 42 cm, 21 cm. (Use π = 22/7).

(ii)The ratio of the volume of a cube to that of a sphere which will exactly fit inside the cube, is $\pi : 6$.

(iii) A well, whose diameter is 7 m, has been dug 22.5 m deep and the earth dugout is used to form an embankment around it. If the

height of the embankment is 1.5 m, then the width of the embankment is 20 m.

A. $\begin{matrix}(i) & (ii) & (iii)\\ F & T & T\end{matrix}$

B. $\begin{matrix}(i) & (ii) & (iii)\\ T & F & F\end{matrix}$

C. $\begin{matrix}(i) & (ii) & (iii)\\ T & T & F\end{matrix}$

D. $\begin{matrix}(i) & (ii) & (iii)\\ F & F & T\end{matrix}$

Answer: B

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