

PAPER-SAT

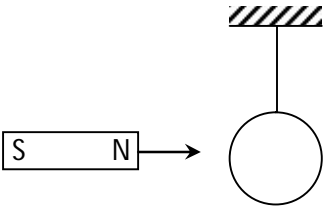
1. An object is placed in front of a concave mirror of radius of curvature 15 cm, at a distance of 10 cm. the position and nature of the image formed is:
 1. + 30 cm, virtual and erect
 2. + 30 cm, real and inverted
 3. -30 cm, virtual and erect
 4. -30 cm, real and inverted

2. The far point of a myopic person is 40 cm. To see the distant objects clearly, the focal length and the power of the lens used should be:
 1. -40 cm, -2.5 D
 2. -25 cm, -4.0 D
 3. 40 cm, -2.5 D
 4. -40 cm, +2.5 D

3. An electric lamp whose resistance is 10 ohm, and a conductor of 2 ohm resistance are connected in series with a 6 V battery. The total current through the circuit and the potential difference across the electric lamp are:
 1. 3.6 A, 6V
 2. 0.5 A, 5 V
 3. 2.0 A, 0.2 V
 4. 0.3 A, 3 V

4. Several electric bulbs designed to be used on a 220 V electric supply are rated 20 W each. How many lamps can be connected in parallel with each other across the two wires of 220 V line if the maximum allowable current is 5 A?
 1. 50
 2. 110
 3. 55
 4. 60

5. A copper ring is suspended by a thread in a vertical plane. If one end of a magnet is brought horizontally towards the ring as shown, the ring will:



 1. move towards the magnet
 2. Not change its position
 3. move away from the magnet
 4. First move towards and then move away from the magnet

6. What is meant by one cycle of a.c.?
 1. going from zero to + maximum
 2. Going from + maximum to zero
 3. going from zero to - maximum and - maximum to zero
 4. all the three mentioned above combined together in same order

7. If the temperature is increased, what will be the effect on the resistance of a conductor?
 1. does not change
 2. decreases
 3. increases
 4. Cannot say

8. The area under velocity-time graph gives:
 1. acceleration
 2. distance
 3. displacement
 4. Velocity

9. A ball of mass 50 g is thrown upwards. It rises to a maximum height of 100 m. At what height its kinetic energy will be reduced to 70%
 1. 30m
 2. 40m
 3. 60m
 4. 70m

10. The Moon is constantly falling towards the Earth.
 1. This statement is absurd
 2. This statement is correct
 3. This statement is wrong
 4. Nothing can be said

11. Voice of which of the following is likely to have maximum frequency?
 1. man
 2. cow
 3. bird
 4. Dog

12. Match the terms in column I with those of column II.

Column-I i. Electric fuse ii. Relay iii. CFL	Column-II A. Chemical effect B. Electric discharge C. Magnetic effect
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- iv. Button cell
- D. Heating effect
1. i-C, ii-B, iii-A, iv-D
 2. i-B, ii-A, iii-C, iv-D
 3. i-D, ii-C, iii-B, iv-A
 4. i-D, ii-B, iii-C, iv-A
13. The rate of evaporation increases with:
1. Increase of surface area,
Increase of temperature,
Decrease in humidity and
Increase in wind speed
 2. Increase of surface area,
Decrease of temperature,
Decrease in humidity and
Decrease in wind speed
 3. decrease of surface area,
Increase of temperature,
Increase in humidity and
Increase in wind speed
 4. decrease of surface
Increase of temperature,
Decrease in humidity and
Decrease in wind speed
14. The number of atoms in 8g oxygen molecules are:
1. 6.022×10^{23}
 2. 3.011×10^{23}
 3. 1.51×10^{23}
 4. 12.044×10^{23}
15. Bromine atom is available in two isotopes, $^{79}_{35}\text{Br}$ (49.7%) and $^{81}_{35}\text{Br}$ (50.3%), the average atomic mass of bromine atom is:
1. 79.016
 2. 80.076
 3. 80.006
 4. 81.016
16. Choose the correct from the following
- i. Salt of a strong acid and a strong base are neutral with pH value of 7.
 - ii. Salt of a strong acid and a weak base are basic with pH value more than 7.
 - iii. Salt of a weak acid and a strong base are acidic with pH value less than 7.
1. i and ii are correct
 2. ii and iii are correct
 3. only i is correct
 4. i and iii are correct
17. Which of the following statement is correct?
- i. German silver is an alloy of silver, copper and zinc.
 - ii. There is no zinc in brass.
 - iii. Bronze is an alloy of copper and tin.
1. i, ii and iii
 2. Only iii
 3. i and iii
 4. i and ii
18. Two metals which will displace hydrogen and two metals which will not displace hydrogen from dilute acids, respectively are:
1. potassium, calcium, aluminium and zinc
 2. Sodium, calcium, zinc and iron
 3. zinc, iron, copper and mercury
 4. Copper, mercury, silver and gold
19. Which out of following hydrocarbons undergo addition reactions?
 C_2H_6 , C_3H_8 , C_3H_6 , C_2H_2 and CH_4
1. C_2H_6 and C_3H_8
 2. C_3H_6 and C_2H_2
 3. CH_4 and C_2H_6
 4. C_3H_8 and C_2H_2
20. Arrange the following atoms in the order of increasing atomic radius:
F, Cl, C, O
1. F, Cl, O, C
 2. C, O, F, Cl
 3. O, C, F, Cl
 4. F, O, C, Cl

21. The pH of solution formed by mixing of 40 ml of 0.10 M HCl and 10 ml of 0.45 M of NaOH is:
1. 10
 2. 12
 3. 8
 4. 6
22. Food cans are coated with tin and not with zinc because:
1. zinc is costlier than tin
 2. Zinc has a higher melting point than tin
 3. zinc is more reactive than tin
 4. Zinc is less reactive than tin
23. Match the following:
- | | |
|---------------|------------------|
| i. Vinegar | P. tartaric acid |
| ii. Orange | Q. oxalic acid |
| iii. Tamarind | R. acetic acid |
| iv. Tomato | S. citric acid |
1. i-Q, ii-R, iii-P, iv-S
 2. i-R, ii-Q, iii-P, iv-S
 3. i-R, ii-S, iii-P, iv-Q
 4. i-S, ii-Q, iii-R, iv-P
24. Which of the following class of animals has coelomic cavity filled with blood?
1. Nematoda
 2. Annelida
 3. Arthropoda
 4. Mollusca
25. Which of the following causes Kala-azar?
1. Leishmania
 2. Trypanosoma
 3. Ascaris lumbricoides
 4. Helicobacter pylori
26. Hydrochloric acid facilitates the action of which enzyme?
1. salivary amylase
 2. pepsin
 3. trypsin
 4. Lipase
27. Lipids and proteins constituting the cell membrane are synthesized at:
1. endoplasmic reticulum
 2. mitochondria
 3. golgi apparatus
 4. Lysosomes
28. Connective tissue with a fluid matrix is:
1. ligament
 2. tendons
 3. blood
 4. Cartilage
29. Normally in a healthy adult the daily initial filtrate in the kidneys is:
1. 18 L
 2. 1.8L
 3. 180L
 4. 9L
30. Which part of the heart receives deoxygenated blood?
1. right atrium
 2. Right ventricle
 3. left atrium
 4. Left ventricle
31. Choose the right from the following.
- i. In light, hormone auxin, helps the cells to grow longer in plants.
 - ii. Plant hormone gibberellins helps in growth of a stem.
 - iii. Cytokinin inhibits cell division.
 - iv. Abscisic acid promote growth in plants.
1. i and iii are correct
 2. ii and iv are correct
 3. i and ii are correct
 4. i and iv are correct
32. Asexual reproduction takes place through budding in:
1. amoeba
 2. yeast
 3. plasmodium
 4. Leishmania
33. Sperm formation requires _____ temperature as in the normal body temperature.
1. same
 2. high
 3. low
 4. Not sure

34. The experiment conducted by Stanley L. Miller and Harold C. Urey in 1953 to show how organic molecules arise in nature, they assembled an atmosphere consisted of:
1. ammonia, methane and oxygen
 2. Ammonia, hydrogen sulphide and oxygen
 3. ammonia, hydrogen sulphide and methane
 4. Methane, hydrogen sulphide and oxygen
35. An example of homologous organs is:
1. our arm and a dog's fore-leg
 2. Our teeth and an elephant's tusks
 3. potato and runners of grass
 4. All of the above
36. How many members are there in the security council of United Nation?
1. 15
 2. 20
 3. 17
 4. 22
37. What is 'Zero Hour'?
1. When the proposals of the opposition are considered
 2. When the matters of utmost importance are raised
 3. When money bill is introduced in the Lok Sabha
 4. Interval between the morning and the evening session
38. In India seats are reserved for women in:
1. Lok Sabha
 2. Rajya Sabha
 3. Panchayati Raj
 4. Cabinet
39. Which of the following is not a permanent member of UN Security Council?
1. China
 2. France
 3. Japan
 4. Russia
40. Which one of the following is a directly elected house?
1. Parliament
 2. Rajya Sabha
 3. Lok Sabha
 4. Vidhan Prishad
41. Who said that religion can never be separated from the politics?
1. Acharya Vinoba Bhave
 2. Mahatma Gandhi
 3. Sarojini Naidu
 4. Dr. Rajendra Prasad
42. Who among the following is a part of Political Executive?
1. District collector
 2. Secretary of the ministry of Home Affairs
 3. Home Minister
 4. Director General of Police
43. Apartheid was the name of a system unique to:
1. South America
 2. South Africa
 3. Asia
 4. Europe
44. When was Universal Adult Franchise granted in India?
1. 1948
 2. 1950
 3. 1952
 4. 1954
45. Which state has more than 30 Lok Sabha constituencies?
1. Assam
 2. Kerala
 3. Rajasthan
 4. Tamil Nadu
46. Who wrote the book 'Hind Swaraj'?
1. Pt. Jawahar Lal Nehru
 2. Moti Lal Nehru
 3. Mahatma Gandhi
 4. Subash Chandra Bose
47. In which "Congress Session" the resolution on Poorna Swaraj was passed?
1. Calcutta Session
 2. Kerachi Session
 3. Lahore Session
 4. Tripura Session
48. When was the French Revolution took place?
1. 1789
 2. 1786
 3. 1795
 4. 1781

49. The Great Depression was a period of
- | | |
|---------------------|--------------------|
| 1. Political crisis | 2. Global crisis |
| 3. Social crisis | 4. Economic crisis |
50. Printing was first developed in:
- | | |
|----------|-------------|
| 1. Japan | 2. Portugal |
| 3. China | 4. Germany |
51. Which one of the following is the ancient name of Tokyo?
- | | |
|----------|----------|
| 1. Osaka | 2. Nagam |
| 3. Edo | 4. Gifu |
52. In which city of India the first cotton mill was established?
- | | |
|--------------------|-----------|
| 1. Ahmadabad | 2. Surat |
| 3. Bombay (Mumbai) | 4. Kanpur |
53. Which battle established the British supremacy in India?
- | | |
|--------------------------|--------------------------|
| 1. The battle of Panipat | 2. The battle of Plassey |
| 3. The battle of Buxor | 4. The battle of Mysore |
54. By selling which of the items to China, did the British regularly collect money for purchasing tea from China?
- | | |
|-----------|--------------|
| 1. Opium | 2. Jute |
| 3. Cotton | 4. Sugarcane |
55. 'Raikas' the Pastoral community lived in which of the Indian state?
- | | |
|-------------------|--------------|
| 1. Andhra Pradesh | 2. Jharkhand |
| 3. Chhattisgarh | 4. Rajasthan |
56. In which year the southernmost point of the India union-'Indira Point' submerged under the sea water.
- | | |
|---------|---------|
| 1. 2000 | 2. 2002 |
| 3. 1998 | 4. 2004 |
57. _____ drainage pattern develops where hard and soft rocks exists parallel to each other.
- | | |
|--------------|----------------|
| 1. Dendritic | 2. Rectangular |
| 3. Trellis | 4. Radial |
58. Which one of the following causes rainfall during winter in the north-western part of India?
- | | |
|------------------------|-------------------------|
| 1. Cyclonic depression | 2. Western disturbances |
| 3. Retreating monsoon | 4. South west monsoon |
59. In India which of the following river forms a second biggest waterfall?
- | | |
|------------|-------------|
| 1. Narmada | 2. Godavari |
| 3. Kaveri | 4. Krishna |
60. Sugarcane crop grows well in the areas with a rainfall of_____.
- | | |
|---------------|---------------------|
| 1. 100-150 cm | 2. 75-100 cm |
| 3. 150-200 cm | 4. 200 cm and above |
61. On which of the following rivers Sardar Sarovar Dam is built?
- | | |
|------------|------------|
| 1. Kaveri | 2. Krishna |
| 3. Narmada | 4. Sutlej |
62. Which port was developed in the wake of loss of Karachi port?
- | | |
|-----------|-------------|
| 1. Mumbai | 2. Paradeep |
| 3. kandla | 4. Marmagoa |
63. India's total area accounts_____ per cent of the total geographical area of the world.
- | | |
|--------|--------|
| 1. 5.0 | 2. 4.0 |
| 3. 2.8 | 4. 2.4 |
64. Majuli, the largest inhabited riverine island is found in the_____ river.

1. Ganga
3. Sutlej
2. Brahmaputra
4. Yamuna
65. El Nino are the_____.
1. cold ocean current
3. trade winds
2. Warm ocean current
4. North east winds
66. Which of the following is a non farm activity?
1. Multiple cropping
3. Dairy farming
2. Crop rotation
4. Modern farming
67. Which one of the following organization prepares 'Human Development report'?
1. UNO
3. IMF
2. WHO
4. UNDP
68. What is the life expectancy of Indians, as per the 2001 Census?
1. 72 Yrs.
3. 64 Yrs.
2. 53 Yrs.
4. 70 Yrs.
69. The National Rural Employment Guarantee Act enacted by legislation on:
1. July 20th 2006
3. August 25th 2004
2. August 25th 2005
4. July 20th 2000
70. Which one of the following is associated with Primary Sector?
1. Lawyer
3. Priest
2. Doctor
4. Gardner
71. Number of real solutions of $(x^2 - 7x + 11)^{x^2 - 11x + 30} = 1$ is:
1. 4
3. 6
2. 5
4. No solution
72. If $\tan^2 \alpha \cdot \tan^2 \beta + \tan^2 \beta \cdot \tan^2 \gamma + \tan^2 \gamma \cdot \tan^2 \alpha + 2 \tan^2 \alpha \cdot \tan^2 \beta \cdot \tan^2 \gamma = 1$ then the value of $\sin^2 \alpha + \sin^2 \beta + \sin^2 \gamma$ is
1. 0
3. 1
2. -1
4. $\frac{1}{2}$
73. If $3 \sin \theta + 5 \cos \theta = 5$, then the value of $5 \sin \theta - 3 \cos \theta = ?$
1. ± 4
3. ± 5
2. ± 3
4. ± 2
74. An aeroplane is flying horizontally at a height of 3150 m above a horizontal plane ground. At a particular instant it passes another plane vertically below it. At this instant, the angles of elevation of the planes from a point on the ground are 30° and 60° . Hence, the distance between the two planes at that instant is:
1. 1050 m
3. 4200 m
2. 2100 m
4. 5250 m
75. Given that $a(a+b) = 36$ and $b(a+b) = 64$, where a and b are positive, (a-b) equals:
1. 2.8
3. -2.8
2. 3.2
4. -2.5
76. If a, b, c are positive, then $\frac{a+c}{b+c}$ is
1. always smaller than $\frac{a}{b}$
3. greater than $\frac{a}{b}$ only if $a > b$
2. Always greater than $\frac{a}{b}$
4. Greater than $\frac{a}{b}$ only if $a < b$

77. ${}^{2010}\sqrt{2\sqrt{7}-3\sqrt{3}} \times \sqrt{55+12\sqrt{21}} = ?$

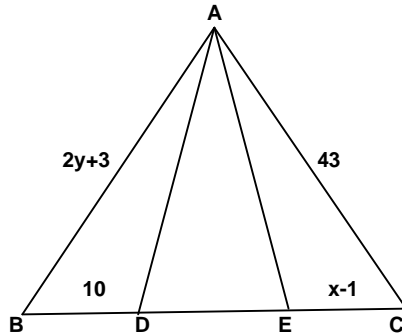
- | | |
|-------|------|
| 1. -1 | 2. 1 |
| 3. 0 | 4. 2 |

78. If the quotient of $x^4 - 11x^3 + 44x^2 - 76x + 48$, when divided by $(x^2 - 7x + 12)$ is $Ax^2 + Bx + C$, then the descending order of A,B,C is:

- | | |
|----------|----------|
| 1. A,B,C | 2. B,C,A |
| 3. A,C,B | 4. C,A,B |

79. The roots of $(x+a)(x+b) - 8k = (k-2)^2$ are real and equal, where $a, b, c \in R$, then

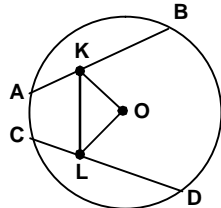
1. $a+b = 0$
2. $a=b$
3. $k=-3$
4. $k=0$



80. In the given figure, $AD = AE$ $\angle BAD = \angle EAC$, then

- | | |
|-----------|-----------|
| 1. $x=11$ | 2. $x=13$ |
| 3. $y=21$ | 4. $y=11$ |

81. In the given circle with centre 'O', the mid points of two equal chords AB & CD are K & L respectively.



If $\angle OLK = 25^\circ$, Then $\angle LKB = ?$

- | | |
|----------------|----------------|
| 1. 125° | 2. 115° |
| 3. 105° | 4. 90° |

82. If $\sqrt{a} + \sqrt{b} - \sqrt{c} = 0$, then the value of $(a+b-c)^2$ is:

- | | |
|----------|----------|
| 1. $2ab$ | 2. $2bc$ |
| 3. $4ab$ | 4. $4ac$ |

83. The length 'L' of a tangent, drawn from a point 'A' to a circle is $\frac{4}{3}$ of the radius 'r'. The shortest distance from A to the circle is:

- | | |
|-------------------|-------------------|
| 1. $\frac{1}{2}r$ | 2. r |
| 3. $\frac{1}{2}L$ | 4. $\frac{2}{3}L$ |

84. A set of number has the sum 'S'. Each number of the set is increased by 20, then multiplied by 5, and then decreased by 20. The sum of the numbers in the new set thus obtained is:

- | | |
|--------------|---------------|
| 1. $S + 20n$ | 2. $5S + 80n$ |
| 3. $5S + 4n$ | 4. $5S$ |

85. A bag contains 5 red balls and some blue balls. If the probability of drawing a blue ball is double that of a red ball, then the number of blue balls in the bag are:
1. 20
 2. 15
 3. 12
 4. 10
86. Consider the points $A(a, b+c)$, $B(b, c+a)$, and $C(c, a+b)$ be the vertices of $\triangle ABC$. The area of $\triangle ABC$ is:
1. $2(a^2 + b^2 + c^2)$
 2. $\frac{a^2 + b^2 + c^2}{6}$
 3. $2(ab + bc + ca)$
 4. None of these
87. The centre of a clock is taken as origin. At 4.30 pm, the equation of line along minute hand is $x = 0$. Therefore at this instant the equation of the line along the hour hand will be:
1. $x+y=0$
 2. $x-y=0$
 3. $y = \sqrt{2}x$
 4. $y = \frac{x}{\sqrt{2}}$
88. A conical vessel of radius 6 cm and height 8 cm is completely filled with water. A metal sphere is now lowered into the water. The size of the sphere is such that when it touches the inner surface, it just gets immersed. The fraction of water that overflows from the conical vessel is:
1. $\frac{3}{8}$
 2. $\frac{5}{8}$
 3. $\frac{7}{8}$
 4. $\frac{5}{16}$
89. If the eight digit number 2575d568 is divisible by 54 and 87, the value of the digit 'd' is:
1. 4
 2. 7
 3. 0
 4. 8
90. $\left\{ \frac{3 \cos 43^\circ}{\sin 47^\circ} \right\}^2 \frac{\cos 37^\circ \cdot \operatorname{cosec} 53^\circ}{\tan 5^\circ \cdot \tan 25^\circ \cdot \tan 45^\circ \cdot \tan 65^\circ \cdot \tan 85^\circ} = ?$
1. 7
 2. 0
 3. 1
 4. 8

SAT SOLUTION

PHYSICS

1. (4) $u = -10 \text{ cm}$, $f = -\frac{15}{2} \text{ cm}$

$$\frac{1}{v} + \frac{1}{u} = \frac{1}{f} \Rightarrow v = -30 \text{ cm}$$

I is real and inverted.

2. (1) $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$, $u = -\infty$

$$\Rightarrow f = -40 \text{ cm}, P = -2.5 \text{ D}$$

3. (2) $R = 10\Omega + 2\Omega = 12\Omega$

$$\Rightarrow I = \frac{6\text{V}}{12\Omega} = 0.5\text{A}$$

$$\Rightarrow V_{\text{Lamp}} = IR = 5\text{V}$$

4. (3) For a Bulb, $V_i = 20\text{W}$

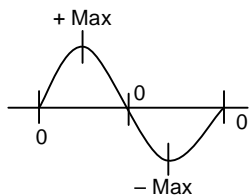
$$i = \frac{1}{11} \text{ A}$$

$$I = ni \Rightarrow 5\text{A} = n \left(\frac{1}{11} \text{ A} \right)$$

$$n = 55$$

5. (2) Ring will be at rest. As flux is zero always.

6. (4) One AC cycle



7. (3) Conductivity increases for metals with rise in temp.

8. (3) $\Delta x = v\Delta t$

Displacement = velocity \times time
= area of v-t graph

9. (1) $H = \frac{u^2}{2g}$

$$h = \frac{u^2}{2g} - \frac{v^2}{2g} = 0.3 \frac{u^2}{2g} = 30\text{m}$$

10. 2

11. 3

12. (3) Electric fuse works on heating effect of current CFL works on electric discharge

CHEMISTRY

13. 1

14. $n = 2 \left\{ \frac{N_A}{4} \right\} = \frac{6.023 \times 10^{23}}{2} = 3.011 \times 10^{23}$

15. Average atomic wt = $\left(79 \times \frac{49.7}{100} + 81 \times \frac{50.3}{100} \right)$
= 80.006 (Answer 3)

16. 3

17. 20

18. 3

19. 2

20. 4

21. Net $[\text{OH}^-] = (4.5 \text{ mmol} - 4 \text{ mmol})$

= 0.5 mmol

$[\text{OH}^-] = \frac{0.5 \text{ mmol}}{50 \text{ ml}} \times 10^{-3} \times 1000 = 0.01 \text{ M}$

$\text{pOH} = -\log[\text{OH}^-] = -\log[1.0 \times 10^{-2}]$

$\text{pOH} = 2$

$\text{pH} = 14 - 2 \Rightarrow 12$

Answer 2

22. 3

23. 3

24. 3

25. 1

26. 2

27. 1

28. 3

29. 3

30. 1

31. 3

32. 2

33. 3

34. 3

35. 4

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36. 1

37. 2

38. 3

39. 3

40. 3

41. 2

42. 3

43. 2

44. 2

45. 4

46. 3

47. 3

48. 1

49. 4

50. 3

51. 3

52. 3

53. 3

54. 1

55. 4

56. 4

57. 3
 58. 2
 59. 3
 60. 2
 61. 3
 62. 3
 63. 4
 64. 2
 65. 2
 66. 3
 67. 4
 68. 3
 69. 2
 70. 4

Mathematics

71. $(x^2 - 7x + 11)^{x^2 - 11x + 30} = 1$

If $x^2 - 7x + 11 = 1$ or $x^2 - 11x + 30 = 0$

$x^2 - 7x + 10 = 0$

$x = 2, 5$ $x = 5, 6$

72. $\tan^2 \alpha \tan^2 \beta + \tan^2 \beta \tan^2 \gamma + \tan^2 \gamma \tan^2 \alpha + 2 \tan^2 \alpha \tan^2 \beta \tan^2 \gamma = 1$

$\Rightarrow \frac{\sin^2 \alpha}{\cos^2 \alpha} \times \frac{\sin^2 \beta}{\cos^2 \beta} + \frac{\sin^2 \beta}{\cos^2 \beta} \times \frac{\sin^2 \gamma}{\cos^2 \gamma} + \frac{\sin^2 \gamma}{\cos^2 \gamma} \times \frac{\sin^2 \alpha}{\cos^2 \alpha} + 2 \frac{\sin^2 \alpha}{\cos^2 \alpha} \cdot \frac{\sin^2 \beta}{\cos^2 \beta} \cdot \frac{\sin^2 \gamma}{\cos^2 \gamma} = 1$

$\Rightarrow \sin^2 \alpha \sin^2 \beta \cos^2 \gamma + \cos^2 \alpha \sin^2 \beta \sin^2 \gamma + \sin^2 \alpha \cos^2 \beta \sin^2 \gamma + 2 \sin^2 \alpha \sin^2 \beta \sin^2 \gamma = \cos^2 \alpha \cos^2 \beta \cos^2 \gamma$

$\sin^2 \alpha \sin^2 \beta (1 - \sin^2 \gamma) + (1 - \sin^2 \alpha) \sin^2 \beta \sin^2 \gamma + \sin^2 \alpha (1 - \sin^2 \beta) \sin^2 \gamma + 2 \sin^2 \alpha \sin^2 \beta \sin^2 \gamma$

$\Rightarrow = (1 - \sin^2 \alpha)(1 - \sin^2 \beta)(1 - \sin^2 \gamma)$

$\Rightarrow \sin^2 \alpha + \sin^2 \beta + \sin^2 \gamma = 1$

73. $3 \sin \theta + 5 \cos \theta = 5$

$(3 \sin \theta + 5 \cos \theta)^2 = 25$

$9 \sin^2 \theta + 25 \cos^2 \theta + 30 \sin \theta \cos \theta = 25$

$9(1 - \cos^2 \theta) + 25(1 - \sin^2 \theta) + 30 \sin \theta \cos \theta = 25$

$9 \cos^2 \theta + 25 \sin^2 \theta - 30 \sin \theta \cos \theta = 9$

$(5 \sin \theta - 3 \cos \theta)^2 = 9$

$5 \sin \theta - 3 \cos \theta = \pm 3$

74. $\frac{3150 - x}{y} = \tan 30^\circ = \frac{1}{\sqrt{3}}$

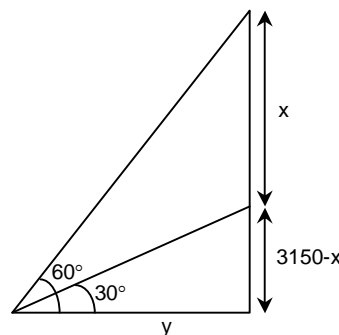
$\frac{3150}{y} = \tan 60^\circ = \sqrt{3}$

$\frac{3150 - x}{3150} = \frac{1}{3}$

$3(3150 - x) = 3150$

$3x = 6300$

$x = 2100$



75. $a(a+b) = 36$ and $b(a+b) = 64$

$$\begin{aligned}
a(a+b) + b(a+b) &= 36 + 64 \\
(a+b)(a+b) &= 100 \\
(a+b)^2 &= 100 \\
a+b &= 10 \\
\therefore 10a &= 36 \quad 10b = 64 \\
\Rightarrow 10(a-b) &= -28 \\
\Rightarrow a-b &= -2.8
\end{aligned}$$

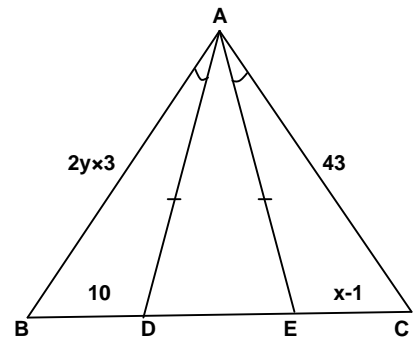
76. $\frac{a+c}{b+c} > \frac{a}{b}$
 $\Rightarrow ab+bc > ab+ca$
 $\Rightarrow bc > ca$
 $\Rightarrow b > a$
 $\Rightarrow a < b.$

77. $\frac{^{2010}\sqrt{2\sqrt{7}-3\sqrt{3}} \times ^{4020}\sqrt{55+12\sqrt{21}}}{^{2010}\sqrt{2\sqrt{7}-3\sqrt{3}} \times ^{4020}\sqrt{(2\sqrt{7}+3\sqrt{3})^2}}$
 $\frac{^{2010}\sqrt{2\sqrt{7}-3\sqrt{3}} \times ^{2010}\sqrt{(2\sqrt{7}+3\sqrt{3})^2}}{^{2010}\sqrt{2\sqrt{7}-3\sqrt{3}} \times ^{2010}\sqrt{(2\sqrt{7}+3\sqrt{3})^2}} = 1$

78. On dividing $x^4 - 11x^3 + 44x^2 - 76x + 48$ by $x^2 - 7x + 12$ we obtain the quotient $x^2 - 4x + 4$
So $Ax^2 + Bx + C = x^2 - 4x + 4$
 $\therefore A = 1, B = -4, C = 4$
In descending order C, A, B.

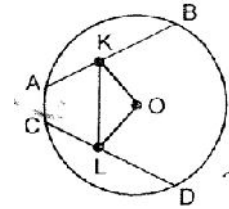
79. We can write $(x+a)(x+b) - 8K = (K-2)^2$
as $x^2 + (a+b)x + ab - 8K - (K^2 - 4K + 4) = 0$
or $x^2 + (a+b)x + ab - K^2 - 4K - 4 = 0$
or $x^2 + (a+b)x + ab - (K+2)^2 = 0$
As roots are real and equal, so
 $(a+b)^2 - 4(ab - (K+2)^2) = 0$
or $(a-b)^2 + 4(K+2)^2 = 0$
 $\therefore a-b = 0$ and $K+2 = 0$
or $a = b$ and $K = -2.$

80 $\triangle ADE$ is isosceles (as $AD = AE$ given)
So $\angle ADE = \angle AED$
 $180^\circ - \angle ADE = 180^\circ - \angle AED$
 $\angle ADB = \angle AEC$
Now in $\triangle ADB$ and $\triangle AEC$
 $\angle BAD = \angle EAC$ (given)
 $AD = AE$ (given)
 $\angle ADB = \angle AEC$ (proved)
 $\therefore \triangle ADB \cong \triangle AEC$ (ASA congruence)



So $AB = AC$ and $BD = CE$ (cpct)
 or $2y + 3 = 43$ and $x - 1 = 10$
 so $y = 20$, $x = 11$.

81. O is the centre of circle. K and L are mid points of Chords AB and CD respectively.
 $\therefore OK \perp AB$ and $OL \perp CD$.
 As $AB = CD$
 $\therefore OK = OL$. (equal chords are equidistant from centre)
 So $\triangle OKL$ is an isosceles.
 $\therefore \angle OKL = \angle OLK = 25^\circ$ (given)
 Therefore $\angle LKB = \angle OKL + \angle OKB = 25^\circ + 90^\circ = 115^\circ$.



82. $\sqrt{a} + \sqrt{b} - \sqrt{c} = 0$
 $\Rightarrow \sqrt{a} + \sqrt{b} = \sqrt{c}$
 $\Rightarrow (\sqrt{a} + \sqrt{b})^2 = c$
 $\Rightarrow a + b + 2\sqrt{a}\sqrt{b} = c$
 $\Rightarrow a + b - c = -2\sqrt{a}\sqrt{b}$
 $\Rightarrow (a + b - c)^2 = (-2\sqrt{a}\sqrt{b})^2 = 4ab$.

83. Given the length of tangent $L = \frac{4}{3}r$, where r is the radius.

or $r = \frac{3L}{4}$.

From the figure $L^2 + \left(\frac{3L}{4}\right)^2 = \left(x + \frac{3L}{4}\right)^2$

$L^2 + \left(\frac{3L}{4}\right)^2 = x^2 + \left(\frac{3L}{4}\right)^2 + 2x\left(\frac{3L}{4}\right)$

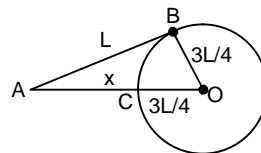
$x^2 + 2\left(\frac{3L}{4}\right)x - L^2 = 0$

$2x^2 + 3Lx - 2L^2 = 0$

or $(x + 2L)(2x - L) = 0$

$\Rightarrow x = -2L$ or $\frac{L}{2}$

We reject $x = -2L$. Hence $x = \frac{L}{2}$.



84. Let there be n numbers

x_1, x_2, \dots, x_n .

So $x_1 + x_2 + \dots + x_n = S$.

According to equation new sum is

$\{5(x_1 + 20) - 20\} + \{5(x_2 + 20) - 20\} + \dots + \{5(x_n + 20) - 20\}$

$= 5(x_1 + x_2 + \dots + x_n) + 80 + 80 + \dots + 80$

$= 5S + 80n$

85. Number of red balls = 5

Let number of blue balls = x

Probability of blue ball = 2 × Probability of red ball

$$\text{or } \frac{x}{x+5} = 2 \times \frac{5}{x+5}$$

$$\Rightarrow x = 10$$

86. $A(a, b+c), B(b, c+a), C(c, a+b)$

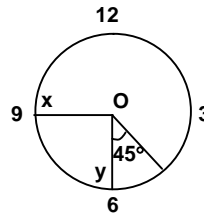
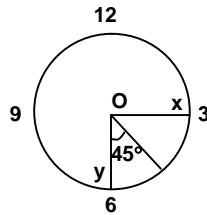
$$\text{Area } (\Delta ABC) = \frac{1}{2} |a(c+a) - b(b+c) + b(a+b) - c(c+a) + c(b+c) - a(a+b)| = 0$$

87. If the centre of the clock is origin and $x = 0$ or y -axis is along minute hand at 4:30 pm then hour hand can have equation

$$y = x$$

$$\text{or } y = -x$$

i.e. $x - y = 0$
or $x + y = 0$



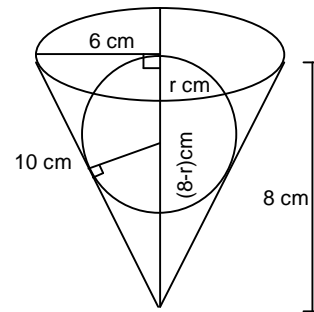
88. From the similarity of triangles $\frac{8-r}{10} = \frac{r}{6}$

$$48 - 6r = 10r$$

$$r = 3.$$

$$\text{Fraction of water overflows} = \frac{\text{volume of sphere}}{\text{volume of cone}} = \frac{\frac{4}{3}\pi(3)^3}{\frac{1}{3}\pi(6)^2(8)}$$

$$= \frac{3}{8}$$



89. So that 2575 d 568 may be divisible by 54 and 87 it should be divisible by 2, 27 and 29. The number is always divisible by 2. So as to make it divisible by 27, it must be divisible by 3 at least. So $d = 1, 4$ or 7 . Now 25751568 and 25754568 are not divisible by 29.

Hence $d = 7$

90.
$$\left(\frac{3 \cos 43^\circ}{\sin 47^\circ} \right)^2 - \frac{\cos 37^\circ \operatorname{cosec} 53^\circ}{\tan 5^\circ \cdot \tan 25^\circ \cdot \tan 45^\circ \cdot \tan 65^\circ \cdot \tan 85^\circ}$$

$$= \left(\frac{3 \sin 47^\circ}{\sin 47^\circ} \right)^2 - \frac{\cos 37^\circ}{\sin 53^\circ} \times \frac{1}{\tan 5^\circ \tan 25^\circ (1) \cot 25^\circ \cot 5^\circ}$$

$$= 3^2 - \frac{\sin 53^\circ}{\sin 53^\circ} \times \frac{1}{\frac{\tan 5^\circ}{\tan 5^\circ} \times \frac{\tan 25^\circ}{\tan 25^\circ}}$$

$$= 9 - 1 = 8$$