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STATE LEVEL SCIENCE TALENT SEARCH EXAMINATION - 2013

SOLUTIONS FOR CLASS : 7

Mathematics

1. (C) Consecutive integers have no common divisor greater than 1.

2. (B) Third expression $= x^2 + y^2 + z^2 - \{(4x^2 - 5y^2 + 3z^2) + (-3x^2 + 4y^2 - 2z^2)\}$
$= 2y^2$

3. (B) $\angle QPF = \angle RSP = 40^\circ$ (RS // PQ, alt. $\angle$s)
In ΔFQP, $x^\circ + 35^\circ + 40^\circ = 180^\circ$
$\Rightarrow x^\circ = 180^\circ - 75^\circ = 105^\circ$

4. (B) Let the number be x.
$$\frac{\left(x-\frac{1}{2}\right)\times 4+25}{3}=10$$
$\Rightarrow 4x - 2 + 25 = 30$
$\Rightarrow 4x = 7$
$\Rightarrow x = \frac{7}{4}$

5. (A) Since $1 \le 1.26 < 10$.

6. (D) $\left(\frac{1}{6}+\frac{1}{7}+\frac{1}{8}+\frac{1}{9}\right)-\left(\frac{1}{6}+\frac{1}{7}+\frac{1}{8}\right)$
$= \frac{1}{9}$

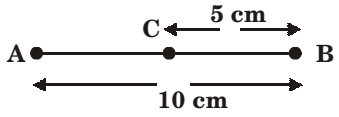
7. (C) $\left[\left(\frac{1}{4}\right)^2-\left(\frac{1}{4}\right)^3\right]\times 2^6$
$=\left(\frac{1}{4}\right)^2\left[1-\frac{1}{4}\right]\times 2^6$
$=\frac{1}{16}\times\frac{3}{4}\times 64$
$= 3$

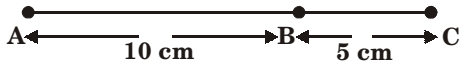
8. (A) $5 \times 2 = 10$

9. (D) Since all the given statements are correct.

10. (A) Let the total length of the post be x m.
Then, the length of post below ground level
$= \frac{x}{2}$ m
The length of post in water $= \frac{x}{3}$ m
Given, $\frac{x}{2}-\frac{x}{3}=3\frac{1}{3}=\frac{10}{3}$
$\Rightarrow \frac{x}{6}=\frac{10}{3} \Rightarrow x = 20$ m

11. (A) Since C is collinear with A and B, C lies either (i) to the left of point B or (ii) to the right of point B.

(i)


(ii)


$\therefore$ In case (i) AC = AB – BC = 10 – 5 = 5 cm
In case (ii) AC = AB + BC = 10 + 5 = 15 cm

12. (D) $\frac{35}{100}x = 80 + 60$
$\Rightarrow \frac{35}{100}x = 140$
$\Rightarrow x = 400$

13. (B) $x \times \frac{-8}{39} = 26$
$\Rightarrow x = \frac{-507}{4}$

14. (A) If $x = 1\times 2\times 3\times 4 = 24$, then n = 1 + 24 = 25
$x = 2\times 3\times 4\times 5 = 120$, then n = 1 + 120 = 121

And $x = 3\times4\times5\times6 = 360$, then $n = 1 + 360 = 361$ are perfect squares.

15. (B) $P - Q + R = (3x - 4y - 8z) - (-10y + 7x + 11z) + (19z - 6y + 4x)$
$= 3x - 4y - 8z + 10y - 7x + 10y - 11z + 19z - 6y + 4x = 0$

16. (A) Since $(-1004) + (-1003) + (-1002) + ... + 0 + ... + 1003 + 1004 + 1005 = 1005$
i.e., the largest number of consecutive integers is 2010.

17. (C) $x = (180^\circ - 140^\circ) + (180^\circ - 158^\circ) = 62^\circ$

18. (B) 12% of ₹ 50 = ₹ 6

19. (B) For the lines 'm' and 'n' to be parallel, corresponding angles should be equal, i.e.,
$\angle 1 = \angle 2$.
$\Rightarrow 26x - 7^\circ = 20x + 17^\circ$
$\Rightarrow 6x = 24^\circ \Rightarrow x = 4^\circ$

20. (A) $\frac{1}{3}(15 + 5 + x) = \frac{1}{4}(x + 7 + 9 + 17)$
$\Rightarrow 80 + 4x = 3x + 99$
$\Rightarrow x = 19$

21. (B) The only rectangle with integer sides and perimeter 22 units are those with dimensions $10\times1, 9\times2, 8\times3, 7\times4$ and 6×5.
$\therefore$ 6×5 rectangle has the largest area i.e. 30 sq. units

22. (A) Least prime number : Least composite number
= 2 : 4
= 1 : 2

23. (C) Arrange the given data in ascending order.
We have, 33, 35, 41, 46, 55, 58, 64, 77, 87, 90 and 92.
The middle most entry is 58.
$\Rightarrow$ Median is 58.

24. (B) When there are 8 people, the share of each is $\frac{1}{8}$ of total fare. When there are 7 people, each person's share is $\frac{1}{7}$ of total fare.

$\therefore$ Increase in share $= \frac{1}{7} - \frac{1}{8} = \frac{1}{56} = \frac{1}{7}\times\frac{1}{8}$

i.e., $\frac{1}{7}$ of $\frac{1}{8}$

i.e., $\frac{1}{7}$ of the original share of each person.

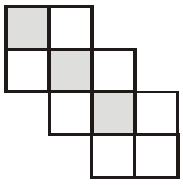
25. (D) The sum of the terms of the given ratio should completely divide 180°, i.e., angle sum of a triangle.
In option (D) sum of terms of ratio = 6 + 7 + 8 = 21, which does not completely divide 180°.

26. (B) $178\times34 = 6052$
$\Rightarrow 17.8\times0.34 = 6.052$
$\Rightarrow 6.052 \div 17.8 = 0.34$

27. (D) $\frac{1}{1\times2} + \frac{1}{2\times3} + \frac{1}{3\times4} + ... + \frac{1}{11\times12} + \frac{1}{12\times13}$
$= \left(1 - \frac{1}{2}\right) + \left(\frac{1}{2} - \frac{1}{3}\right) + ... + \left(\frac{1}{12} - \frac{1}{3}\right)$
$= 1 - \frac{1}{13} = \frac{12}{13}$

28. (B) Correct ans : Incorrect ans = 5 : 2
Incorrect ans = 16
Correct ans = x
$\Rightarrow \frac{5}{2} = \frac{x}{16}$
$\Rightarrow \frac{5\times16}{2} = x$
$\Rightarrow 40 = x$
$\therefore$ Correct answers = 40

29. (C) Let the angles of the triangle be $5x$, $3x$ and $2x$. Then, $5x + 3x + 2x = 180^\circ$
$\Rightarrow 10x = 180^\circ$
$\Rightarrow x = 18^\circ$
$\therefore$ The angles are $5\times18^\circ, 3\times18^\circ, 2\times18^\circ$, i.e., $90^\circ, 54^\circ$ and 36°.
Hence, the triangle is a right triangle.

30. (A) 
$\frac{3}{10} = 0.3$

31. (D) The ascending order of heights is,
6000 m < 6500 m < 7500 m < 8200 m < 8600 m < 8800 m.
The heights of the two middle peaks are 7500 m and 8200 m.
Average height $= \frac{7500 + 8200}{2}$

$= \frac{15700}{2} = 7850\,\text{m}$

32. (C) Let the required fraction be x. Then x of

$$\frac{4}{7}+\frac{4}{7}=1\frac{1}{14}$$

$$\Rightarrow \frac{4x}{7}+\frac{4}{7}=\frac{15}{14}$$

$$\Rightarrow \frac{4x}{7}=\frac{15}{14}-\frac{4}{7}=\frac{7}{14}=\frac{1}{2}$$

$$\Rightarrow x=\frac{1}{2}\times\frac{7}{4}=\frac{7}{8}$$

33. (A) Since the side opposite to the greatest angle is the greatest, the ratio of sides = ratio of corresponding angles = 30 : 60 : 90 = 1 : 2 : 3.

34. (C) Given,

$$2.5+0.05-\left[1.6-\left\{3.2-\left(3.2+\frac{2.1}{x}\right)\right\}\right]=0.65$$

$$2.5+0.05-\left[1.6-\left\{3.2-3.2-\frac{2.1}{x}\right\}\right]=0.65$$

$$\Rightarrow 2.55-\left[1.6+\frac{2.1}{x}\right]=0.65$$

$$\Rightarrow 2.55-1.6-\frac{2.1}{x}=0.65$$

$$\Rightarrow 0.95-\frac{2.1}{x}=0.65$$

$$\Rightarrow \frac{2.1}{x}=0.95-0.65=0.30$$

$$\Rightarrow x=\frac{2.10}{0.30}=\frac{210}{30}=7$$

35. (A) $$\frac{(x+2)\times 60+x\times 120+(x-2)\times 180}{x+2+x+x-2}=100$$

$$\Rightarrow \frac{60x+120+120x+180x-360}{3x}=100$$

$$\Rightarrow 360x-240=300x$$

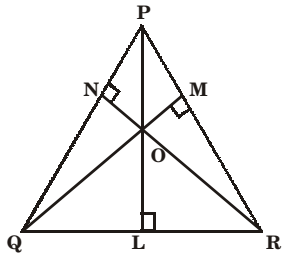
$$\Rightarrow 60x=240$$

$$\Rightarrow x=4$$

36. (B) A line has two end points.

37. (D) $\frac{4}{5} = 0.80$, 81% = 0.81

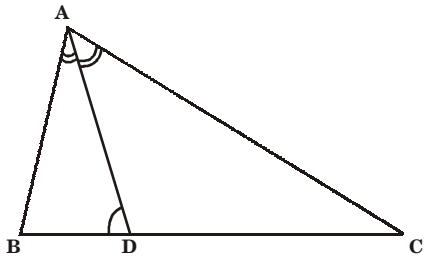
38. (D) Orthocentre is the point of intersection of altitudes. OL is an altitude for ΔQOR.



$\therefore$ P is the orthocentre of ΔQOR.

39. (C) ₹ 7.50×30.5 = ₹ 228.75

40. (B) AD bisects $\angle BAC \Rightarrow \angle DAC = \frac{1}{2}\angle BAC$



An exterior angle of a triangle is always greater than its interior opposite angle.

$\therefore \angle BDA > \angle DAC \Rightarrow \angle BDA > \frac{1}{2}\angle BAC$

41. (B) $-9 + 4 = 5$

42. (B) Since Δ ACB $\cong \Delta$ DFE, $\angle C = \angle F$

$\Rightarrow 6x^2 = 5x^2 + 16^\circ \Rightarrow x^2 = 16^\circ \Rightarrow x = 4$

$\therefore \angle F = 5(4)^2 + 16^\circ = 96^\circ$

43. (B) Sum of the reciprocals of $\frac{3}{5}$ and $\frac{7}{3}$

$$= \frac{5}{3}+\frac{3}{7}=\frac{35+9}{21}=\frac{44}{21}$$

$\therefore$ The required number = $\frac{21}{44}$

44. (B) ΔPQR is an obtuse angled triangle, so the orthocentre lies in the exterior of the triangle.

45. (D) $\angle BPC = 58^\circ$

$\angle n = 180^\circ - 58^\circ = 122^\circ$

$\angle BCP = 180^\circ - (58^\circ + 58^\circ) = 64^\circ$

$\angle m = \angle ADC = \angle BCP = 64^\circ$

$\therefore \angle m + \angle n = 64^\circ + 122^\circ = 186^\circ$

General Science

46. (A) When a piece of magnesium ribbon is burnt in air, it produces a brilliant, white and dazzling light.

$$\underset{\text{Magnesium}}{2Mg} + \underset{\text{Oxygen}}{O_2} \rightarrow \underset{\text{Magnesium oxide}}{2MgO}$$

47. (B) Average speed = $\frac{\text{Distance travelled}}{\text{time taken}}$

$$= \frac{(20 \times 1000)\ \text{m}}{(30 \times 60)\ \text{s}} = 11.1\ \text{m s}^{-1}$$

48. (C) A ball falls down on to the ground because of force of gravity.

49. (A) (i) By adding one more battery or cell in the box ☒ of the given circuit, the bulb already glowing can be made to glow more brightly.

(ii) Production of chemical energy by two cells is more than the consumption of electrical energy by one bulb to light up more brightly than before.

50. (A) (i) Citric acid is present in all citrus fruits including orange.

(ii) Lactic acid bacteria help in the formation of curd from milk.

(iii) Uric acid is present in urine of most of the living beings

i-r, ii-p, iii-q

51. (C) Heat is a form of energy. Heat lost from tea is gained by ice-cream. The hot vapours from the tea made the ice-cream to melt and fall as liquid in the glass.

52. (D) When electricity flows through the given appliances, following heating effects are observed.

(i) In a toaster, a slice of bread is roasted.

(ii) An immersion coil, when kept in a bucket of water becomes hot after sometime.

(iii) A microwave oven has a knob to set different temperatures for cooking or heating substances.

53. (C) The reflected ray of 'Q' is 'R'. According to the laws of reflection, the angle of incidence is equal to the angle of reflection.

54. (B) Iron articles are coated with a layer of zinc or chromium to prevent them from rusting. This process is called galvanisation.

55. (A) The minimum temperature of a day is recorded early in the morning.

56. (D) Temperature, rain, wind speed and humidity are the factors that show their effect on the lives of human beings and other living organisms.

57. (D) (i) A pendulum in a clock undergoes oscillatory motion as it moves from one extreme end to the other in the form of oscillations. 1 to and fro motion = 1 oscillation.

(ii) As this oscillatory motion is repeated at regular intervals of time, it also undergoes periodic motion.

58. (D) Acids have H^+ positive ions and bases have OH^- negative ions as given below.

Acids $\underline{H}Cl$ – Hydrochloric acid
$\underline{H}NO_3$ – Nitric acid
$\underline{H}_2SO_4$ – Sulphuric acid
Bases $NaO\underline{H}$ – Sodium hydroxide
$Mg(O\underline{H})_2$ – Magnesium hydroxide
$Ca(O\underline{H})_2$ – Calcium hydroxide

59. (A) (i) Michael Faraday invented a transformer and also the first electric generator called dynamo in the year 1831.

(ii) Electric bulb was invented by Thomas Alva Edison.

60. (D) The following precautions must be followed after a cyclone has occurred.

(i) Avoid coming in contact with loose and hanging wires. It may lead to shock.

(ii) It is preferrable to drink and cook with the water already stored as fresh water is contaminated.

(iii) Go out, if the water level recedes, otherwise you will be drowned.

61. (C) Chlorine gas is passed into water, to kill germs.

62. (D) Use of chemical fertilizers in the place of natural organic manures has adverse effect in the nature of soil. Though chemical fertilizers enhance the production of food grains, they increase both the acidity and basicity of the soil.

63. (A) Sea and land breezes are caused due to uneven heating of the earth.

64. (D) Treatment of waste water involves removal of physical, chemical and biological matter that contaminate water.

65. (B) 1000 W = 1 KW

Electrical energy (in KWH) consumed by 10 bulbs for 5 hours every day for 30 days

$$= \text{Total Wattage} \times \text{Hours of use} \times \frac{30}{1000}$$

$$= (10\ \text{bulbs} \times 60\ \text{W}) \times 5 \times \frac{30}{1000}$$

$$= 6\cancel{00} \times 5 \times \frac{3\cancel{0}}{1\cancel{000}} = 90\ \text{KWH or units}$$

Cost of each unit = ₹ 3

∴ Cost of 90 units = 90 × ₹ 3 = ₹ 270

66. (B) (i) The period between 2005 – 2015 was declared as the International Decade for action on "Water for Life"

(ii) It was decided on World water day.

67. (D) When an object is placed in front of a plane mirror, an image is formed with its sides reversed. The right side of the object appears as left and left of the object appears as right. This phenomenon of reversal of sides of images is called lateral inversion.

68. (C) (i) Turmeric powder is a natural indicator.

(ii) When a pinch of this powder is added to lime water (calcium hydroxide) a base, it changes to red colour.

69. (A) Convert km/h into m/s

1 km = 1000 m

1 hour = 60 × 60 = 3600 s

$$= \frac{\cancel{1000}^{5}}{\cancel{3600}_{18}} = \frac{5}{18} \text{ m/s}$$

$$\text{Speed of a jet} = \cancel{180}^{10} \times \frac{5}{\cancel{18}_{1}} = 50 \text{ m/s}$$

70. (D) Even when the cyclone is very far, strong winds push water towards the shore causing huge water waves which are powerful.

71. (D) The conditions on which the climate of a place depends are

(i) amount of sunlight received.

(ii) presence or absence of water bodies like ponds, lakes, rivers etc.

(iii) location of a place nearer or far away from the sea, hills, mountains and plains.

(iv) the amount of water evaporated from water bodies, % of water vapour present in a particular place and the amount of rainfall received in that year.

72. (C) (i) Copper sulphate solution is blue in colour.

When an iron nail is dropped into this solution, a chemical change occurs between them as below:

$$\underset{\text{(blue)}}{CuSO_4} + \underset{\text{(iron nail)}}{Fe} \rightarrow \underset{\text{(green)}}{FeSO_4} + \underset{\text{(iron nail coated with copper turns brown}}{Cu}$$

(ii) The change in colour of the solution is due to the formation of Iron sulphate, a new substance.

(iii) The brown deposit on the iron nail is copper, another new substance.

73. (C) Thermistor thermometer is specially designed to measure the temperature of infants and small children.

74. (B) Formic acid is released into the skin of human beings when an ant bites. Due to the release of acid, burning sensation and pain occurs in that area.

75. (D) When a torch light is ON, a divergent beam of light rays spread out in all directions.

76. (B) Mushroom is a non-flowering (fungus) plant. It is a sapropryte as it feeds on dead and decaying organic matter. It forms a part of special dishes.

77. (C) Woollen clothes are soft to touch and hold a lot of air. Woollen clothes are good insulators of heat and provide warmth to the body.

78. (B) When air is blown into the test tube containing lime water. The lime water turns milky due to CO_2 gas i.e. present in exhaled air.

79. (C) Cuscuta is a parasitic plant, nepenthes is an insectivorous and mould is saprophytic.

80. (D) The part of the leaf that is covered with black paper cannot synthesise its food as it has not received sunlight. This experiment proves that sunlight is a basic need of plant.

81. (D) In the given classification 'X' represents root and 'Y' an underground stem.

82. (B) The part of the leaf that contains chlorophyll pigment can perform photosynthesis and produce starch. When iodine solution is added to the variegated leaf to test the presence of starch only the green area turns to blue black colour.

83. (B) Potato, ginger, onion and sugarcane reproduce by vegetative reproduction.

84. (D) Lion is a flesh eating animal. It kills other animals for food.

85. (B) Beans, peas, pulses and meat are the food items rich in proteins.

86. (B) The given plant is an insectivorous plant. It grows mineral deficient soil. It captures prey such as, insects, spiders, etc. as a nitrogen source.

87. (D) In the given figure arrows labelled R and S represents the process of photosynthesis.

88. (D) The given fruit is of the pea family. It gets dispersed by explosion or by splitting mechanism and seeds are carried away by wind.

89. (C) Silk and wool are animal fibres. We get silk from silkworm and wool from the fleece of sheep.

90. (D) The path of respiratory system is Nose – Windpipe – Lungs – blood.