PRELIMINARY INTERVIEW BOARD

TERRITORIAL ARMY COMMISSION : JULY 2017

PAPER: 1 REASONING & ELEMENTARY MATHEMATICS

Max Time : 2 Hours **Max Marks : 100**

Roll No_____

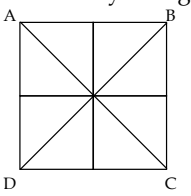
(Please read the instructions carefully)

INSTRUCTIONS

1. Paper 1 has two parts- Part I and Part II.
   (a) Part I – Reasoning (50 Marks).
   (b) Part II – Elementary Mathematics (50 Marks).
2. Each section carries 50 objectives type of questions.
3. There will be four possible answers to every question. Candidates are required to fill correct answer in the OMR sheet with Black ball pen only.
4. For each correct answer, 1 mark will be granted and 0.5 mark will be deducted for every wrong answer.
5. If a candidate gives more than one answer, it will be treated as a wrong answer and half mark will be deducted. There will be no penalty for questions left unanswered.
6. Candidates should not mark in the question paper. They can use blank pages provided in the question paper for rough work.
7. To be eligible to quality, candidate must obtain minimum 40% marks each in section I & II separately and a minimum of 50% aggregate in total.

PART - I REASONING

Q 1. How many triangles are there in the given figure?

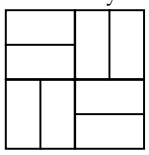


(a) 16 (b) 14 (c) 8 (d) 12

Explanation

16

Q 2. How many rectangles are there in the given figure?



(a) 24 (b) 16 **(c) 21** (d) 14

Explanation

21

Q 3. In a row of girls, kamla is 9th from the left and veena is 16th from the right. If they interchange their positions. Kamla becomes 25th from the left. How many girls are there in the row?

(a) 34 **(b) 40** (c) 36 (d) 41

Explanation

When Kamla interchanged her position, new position will be 25th from left and 16th from right. Total girls are 24 + Kamla +16 = 40

Q 4. Five students are standing one behind the other in the play ground facing the instructor. Malini is behind Anjana, but in front of Gayatri. Meena is in front of Sheena, but behind Gayatri. What is the position of Meena?

(a) Second from Last (b) Extreme First (c) Extreme Last (d) Second from first

Explanation

Final ranking of position order is Anjana > Malini > Gayatri > Meena > Sheena. Hance Meena is second from last.

Q 5. Sita is elder than Swapna. Lavanya is elder than Swapna but younger than Sita. Suvarna is younger than both Hari and Swapna. Swapna is elder than Hari. Who is the youngest?

(a) Sita (b) Lavanya **(c) Suvarna** (d) Hari

Explanation

Final ranking of old in descending order is Sita > Lavanya > Swapna > Hari > Suvarna. Hence, Suvarna is youngest.

Q 6. C is A's father's nephew. D is A's Cousin but not brother of C. How is D related to C?
(a) Father **(b) Sister** (c) Mother (d) Aunt

Explanation

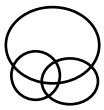
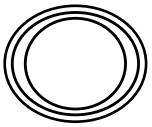
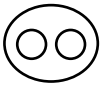
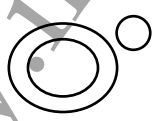
C is A's father's nephew means C is the son of A's father's brother i.e, C is the cousin of A. D is also A's cousin. So, D must be real brother or sister of C. But D is not brother of C. So, D must be sister of C.

Q 7. Deepak said to Nitin, "That Boy playing football is the younger of the two brothers of the daughter of my father's wife" How is the boy playing football related to Deepak?
(a) Son (b) Nephew **(c) Brother** (d) Cousin

Explanation

Deepak's Father's wife is Deepak's mother. Deepak's Mother's daughter is Deepak's sister. Deepak's sister's younger brother is Deepak's younger brother. So, the boy is Deepak's brother.

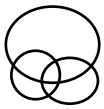
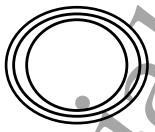
Q 8. Which diagram depicts relationship between Nitrogen, Ice, Air?

(a)  (b)  (c)  **(d)** 

Explanation

Nitrogen gas is a part of air while ice is different from these.

Q 9. Which diagram depicts relationship between Bus, Car, Vehicle?

(a)  (b) 

(c)  (d) 

Explanation

Bus and car are different from each other. But both these are parts of Vehicle.

Q 10. If CUSTOM is written as UCTSMO then how PARENT will be written in the same code?
(a) ERAPTN (b) TNERAP (c) RAPTNE **(d) APERTN**

Explanation

First and second letters are interchanged, third and fourth letters are interchanged, fifth and sixth letters are interchanged to obtain the code.

Q 11. If CAT is coded as 3120, what code number can be given to NAVIN?
(a) 14122914 (b) 49274654 (c) 73957614 (d) 43245654

Explanation

Numbers are given according to the position of alphabets: C=3, A=1, T=20. So CAT=3120. Thus numbers for NAVIN are 14122914 as N=14, A=1, V=22, I=9, N=14.

Q 12. If in a certain code EDITION is written as 3891965, then how TIDE will be written in that code?
(a) 3819 **(b) 1983** (c) 1839 (d) 1586

Explanation

The alphabets are coded as follows: E=3, D=8, I=9, T=1, I=9, O=6, N=5. Thus the code for TIDE is 1983.

Q 13. If FADE is coded as 3854 then how can GAGE be coded?
(a) 1824 (b) 2834 **(c) 2824** (d) 2814

Explanation

The alphabets are coded as follows: F=3, A=8, D=5, E=4. Thus the code for GAGE is G=?, A=8, G=?, E=4, In order to write the code for GAGE, we have to determine the code for G only, the same number is given at two places. Therefore, the code for G is 2.

Directions: In each of the following questions, four words are given, out of which three are alike in some manner and the fourth one is different. Choose the odd one.

Q 14. (a) Wood (b) Cork **(c) Stone** (d) Paper

Explanation

All except Stone are obtained directly or indirectly from trees.

Q 15. (a) Commander (b) Commodore (c) Admiral **(d) Brigadier**

Explanation

All except Brigadier are ranks in navy, while Brigadier is a rank in army.

Directions: In each of the following questions, certain pairs of words are given, out of which the words in all pairs except one, bear a certain common relationship. Choose the pair in which the words are diffently related

Q 16. (a) Steel : Utensils (b) Bronze : Statue (c) Duralumin : Aircraft **(d) Iron : Rails**

Explanation

In all other pairs, first is the alloy used to make the second. Iron is not an alloy, but a metal.

Q 17. (a) **Tongue : Taste** (b) Eye : Blind (c) Ear : Deaf (d) Leg : Lame

Explanation

In all other pairs, second indicates a state of non-functioning of the first.

Directions: In each of the following questions, four numbers are given, out of which three are alike in some manner while the fourth one is different. Choose the one different from the rest.

Q 18. (a) 25631 **(b) 33442** (c) 34424 (d) 52163

Explanation

In all other numbers, sum of digits is 17.

Q 19. (a) 2468 **(b) 2648** (c) 4826 (d) 6482

Explanation

All other numbers contain all four consecutive even numbers but not in proper order.

Q 20. (a) 3:12 (b) 4:20 (c) 6:42 **(d) 7:63**

Explanation

In all other pairs, (1st number) × (1st number + 1st number) = 2nd number.

Directions: In each of the following questions, a number series is given with one term missing. Choosing the correct alternative that will continue the same pattern.

Q 21. 3, 20, 63, 144, 275, ____

(a) 554 (b) 548 **(c) 468** (d) 354

Explanation

The pattern is a combination of three series : 1st series follows 17 + 43 + 81 + 131. 2nd series follows 26 + 38 + 50. 3rd series follows 12 + 12. Clearly, the pattern in the 3rd series is + 12. So, missing term in the 3rd series is 50 + 12 = 62. missing term in the 2nd series is 131 + 62 missing term in the 1st series is 275 + 193 = 468. Thus, the missing term is 468.

Q 22. 8, 12, 18, 27, ____

(a) 36 (b) 44 (c) $37\frac{1}{2}$ (d) $\mathbf{40\frac{1}{2}}$

Explanation

The pattern is 8 (8 × 3) ÷ 2 = 12 (12 × 3) ÷ 2 = 18 (18 × 3) ÷ 2 = 27 (27 × 3) ÷ 2 = 40.5. Thus, the missing term is 40.5 i.e. $40\frac{1}{2}$

Q 23. 8, 29, 113, 449, ____

(a) 673 (b) 984 (c) 1484 (d) **1793**

Explanation

The pattern is 8 (8 × 4) – 3 = 29 (29 × 4) – 3 =113 (113 × 4) – 3 = 449 (449 × 4) – 3 = 1793. Thus, the missing term is 1793

Q 24. $\frac{2}{3}, \frac{4}{7}, ?, \frac{11}{21}, \frac{16}{31}$

(a) $\frac{5}{9}$ (b) $\frac{6}{11}$ **(c)** $\mathbf{\frac{7}{13}}$ (d) $\frac{9}{11}$

Explanation

The pattern is 2 + 2 = 4 + 3 = $\boxed{7}$ *+ 4 = 11 + 5 = 16 and 3 + 4 = 7 + 6 =* $\boxed{13}$ *+ 8 = 21 + 10 = 31. Thus, the missing term is* $\frac{7}{13}$

Directions: In each of the following questions, various terms of an alphabet series are given with one missing term as shown by (?) choose the missing term out of the given alternatives.

Q 25. N5V, K7T, ?, E14P, B19N

(a) H9R (b) H10Q **(c) H10R** (d) I10R

Explanation

Letters and numbers are given in alphanumeric series follows this pattern –

First letter : N (-3), K (-3), $\boxed{H}$ *(-3), E (-3), B (-3)…*

Second number : 5 (+2), 7 (+3), $\boxed{10}$ *(+4), 14 (+5), 19…*

Third letter : V (-2), T (-2), $\boxed{R}$ *(-2), P (-2), N (-2)…..*

Q 26. J2Z, K4X, I7V, ?, H16R, M22P
(a) I11T (b) L11S (c) L12T **(d) L11T**

Explanation

The first letters in odd numbered terms from series J, I, H, and in even numbered terms from the series K, L, M. The sequence followed by the numbers is + 2, + 3, + 4, + 5, + 6. The third letter of each term is moved two steps backward to obtain the third letter of the next term..

Q 27. C4X, F9U, I16R, ?
(a) K25P (b) L259 **(c) L25O** (d) L27P

Explanation

The first letter of each term is moved three steps forward and the last letter is moved three steps backward to obtain the corresponding letters of the next term. The numbers from the sequence 2^2, 3^2, 4^2, 5^2.

Directions: In each of the following questions, various terms of an alphabet series are given with one missing term as shown by (?)– choose the missing term out of the given alternatives.

Q 28. AB, DEF, HIJK, ?, STUVWX
(a) LMNO (b) LMNOP **(c) MNOPQ** (d) QRSTU

Explanation

The number of letters in the terms goes on increasing by 1 at each step. Each term consists of letters in alphabetical order. The first letter of each term is two steps ahead of the last letter of the preceding term

Q 29. AYBZC, DWEXF, GUHVI, JSKTL, ?
(a) MQORN **(b) MQNRO** (c) NQMOR (d) QMONR

Explanation

First letter of each term follows this pattern -: A (+3) = D (+3) = G (+3) = J (+3) = M.

Second letter of each term follows this pattern -: Y (-2) =W (-2) =U (-2) = S (-2) = Q.

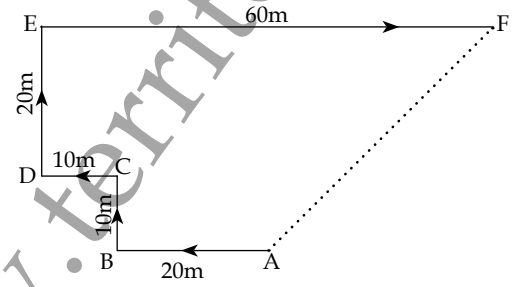
Third letter of each term follows this pattern -: B (+3) = E (+3) = H (+3) = K (+3) = N.

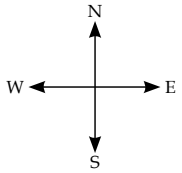
Fourth letter of each term follows this pattern -: Z (-2) = W (-2) = V (-2) =T (-2) = R.

Fifth letter of each term follows this pattern -: C (+3) = (F+3) = I (+3) = L (+3) =O.

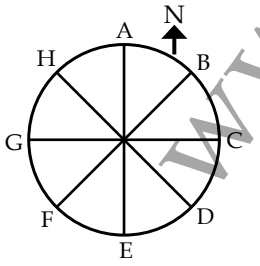
Q 30. I am facing in Southern Direction I turn Right and walk 20 m. Then I turn right and walk 10 m. Then again I turn left and walk 10 m. Then again I turn right and walk 20 m. Once again I turn right and walk 60 m. In which direction I am from (starting) Initial point?
(a) North (b) North West (c) East **(d) North East**

Explanation





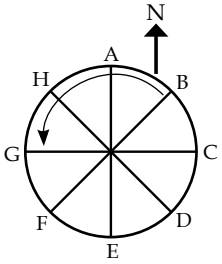
Q 31. Eight people A, B, C, D, E, F, G and H placed as shown in the diagram. All are facing in the outward direction. If all of them move anticlockwise to three place then.

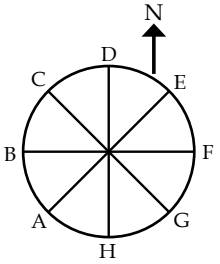


(a) B is facing West (b) E is facing East (c) H is facing North West (d) A is facing South

Explanation

If all of them move anticlockwise to three places the new position will be –





Q 32. On what dates of March, 2013 did Wednesdays fall?

(a) 6, 13, 20, 27 (b) 5, 12, 19, 26 (c) 4, 11, 18, 25 (d) 7, 14, 21, 28

Explanation

We need to find out the day of 01-March-2013

01-March-2013 = (2000 years + period from 1-Jan-2001 to 01-March-2013)

We know that number of odd days in 400 years = 0
Hence the number of odd days in 2000 years = 0 (Since 2000 is a perfect multiple of 400)
13 years are equal to 4745 day + 3 leap days = 4748 divide by 7 = 678 weeks and 2 days
2 (left days) + 31 (Jan) +28 (Feb) Total = 61 day divide by week = 8 weeks and 5 days

As 0 day means Sunday thus 5 days means Friday. So 1 March 2013 was Friday

Hence first Wednesday of March 2013 comes in 06th and successive Wednesdays come in 13th, 20th and 27th .

Q 33. A watch which gains uniformly is 4 minute slow at 9 A.M. on Sunday, and is 4 minutes 15 sec. fast at 9 P.M. on next Friday. When was it correct?

(a) 2 A.M. Thursday (b) 6 P.M. Wednesday **(c) 1 A.M. Wednesday** (d) 6 P.M.

Explanation

Time from 9 A.M Sunday to 9 P.M Friday = 5 day 12 hours. In 132 hours the clock gains (8 minutes 15 seconds is equal to 8.25 minutes) 8.25 minutes, or 0.0625 minutes per hour. To be "on time" the clock must gain 4 minutes. That takes (4 ÷ 0.0625) = 64 hours. 64 hours from 9 A.M. Sunday would be 1 A.M. Wednesday.

Q 34. The minute hand of a clock overtakes the hour hand at interval of 64 minutes of correct time. How much a day does the clock gain or lose?

(a) $43\frac{9}{11}$ minutes loss **(b) $\mathbf{32\frac{8}{11}}$ minute gain**

(c) $33\frac{9}{11}$ minute gain (d) $32\frac{8}{11}$ minute loss

Explanation

55 min. spaces are covered in 60 min.

$$60 \text{ min. spaces are covered in } \left(\frac{60}{65} \times 60\right) \text{min.} = 65\frac{5}{11} \text{ min.}$$

$$\text{Loss in 64 min.} = \left(65\frac{5}{11} - 64\right) = \frac{16}{11} \text{ min.}$$

$$\text{Loss in 24 hrs} = \left(\frac{16}{11} \times \frac{1}{64} \times 24 \times 60\right) \text{min.}$$

$32\frac{8}{11}$ *minute gain*

Directions: Each of the following questions is based on the following alphabet series

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

Q 35. Which letter is sixteenth to the right of the letter which is fourth to the left of I?

(a) S (b) T **(c) U** (d) V

Explanation

Clearly, the fourth letter to the left of I is E. The sixteenth letter to the right of E is U.

Q 36. Which letter is exactly midway between G and Q in the given alphabet?

(a) K **(b) L** (c) M (d) N

Explanation

There are nine letters between G and Q, clearly the middle letter is L

Q 37. Which letter is midway between the eighteenth letter from the left end and tenth letter from the right end of the given alphabet?

(a) No letter (b) K (c) Q (d) R

Explanation

R is eighteenth letter from the left end Q is tenth letter from the right end. Clearly no letter is midway between Q and R.

Q 38. Statements

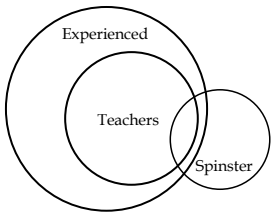
(a) All teachers are experienced. (b) Some teachers are spinsters.

Conclusions

(I) Some experienced are spinsters (II) Some spinsters are experienced.

(a) Only conclusion I or II follow (b) Either conclusion I or II follow
(c) Both conclusion I and II follow (d) Only conclusion I follows

Explanation



Q 39. Statements

(a) Some cats are dogs. (b) No dog is a toy.

Conclusions

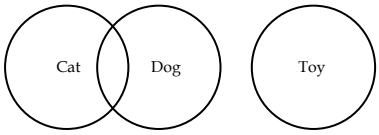
(I) Some dogs are cats. (II) Some toys are cats.

(III) Some cats are not toys. (IV) All toys are cats.

(a) Only conclusion I and III follow (b) Only conclusion II and III follow

(c) Only conclusion I and II follow **(d) Only conclusion I follows**

Explanation



Q 40. Find Missing Term.

2	9	11	7
8	5	13	-3
7	?	10	(-4)
6	4	10	?

(a) 3 and 2 (b) (-3) and 2 **(c) 3 and (-2)** (d) (-3) and (-2)

Explanation

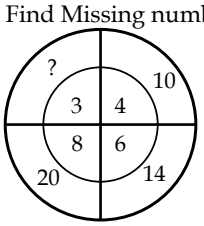
I row + 2 + 9 = 11 – 2 + 9 = 7

II row + 8 + 5 = 13– 8 + 5 = – 3

III row + 7 + $\boxed{3}$ = 10 – 7 + 5 = (– 4)

IV row + 6 + 4 = 10 – 6 + 4 = $\boxed{(– 2)}$

Q 41. Find Missing number.



(a) 19 (b) 18 (c) 24 (d) 12

Explanation

Total sum of diagonally numbers is 42

20 + 8 + 4 + 10 = 42

14 + 6 + 3 + $\boxed{19}$ = 42

Q 42. Find the Missing Term.

67	91	45
78	90	36
?	81	27

(a) 95 **(b) 98** (c) 105 (d) 111

Explanation

67 + 91 + 45 = 203

78 + 90 + 36 = 204

$\boxed{98}$ + 80 + 27 = 205

Q 43. Find Missing Term.

7	9	8
2	4	3
5	7	6
16	32	?

(a) 17 **(b) 23** (c) 47 (d) 73

Explanation

$7 + 2^2 + 5 = 16$

$9 + 4^2 + 7 = 32$

$8 + 3^2 + 6 = \boxed{23}$

Directions: In each of the following questions, a letter number series is given with one or more terms missing as shown by (?). Choose the missing term out of the given alternatives.

Q 44. $\sqrt{AFI} : 13 :: \sqrt{ADD} = ?$

(a) 12 (b) 22 (c) 21 (d) 24

Explanation

$\sqrt{AFI} : 13 :: \sqrt{ADD} : ?$

$\downarrow\downarrow\downarrow \quad \downarrow\downarrow\downarrow$

$\sqrt{169} : 13 :: \sqrt{144} : \boxed{12}$ *Thus the code for ADD is 144 so 144 = 12 × 12.*

Q 45. RUST : 9687 : : TSUR

(a) 7896 **(b) 7869** (c) 7689 (d) 6789

Explanation

The alphabets are coded as follows : R=9, U=6, S=8, T=7. Thus the code for TSUR is 7869.

Directions: In the following questions you have to identify the correct response from the given premises stated according to following symbols.

Q 46. If ÷ means +, - means ÷, × means – and + means ×

then $\dfrac{(36 \times 4) - 8 \times 4}{4 + 8 \times 2 + 16 \div 1}$

(a) 0 (b) 8 (c) 12 (d) 16

Explanation

Using the correct symbols we get expression given below

$$\frac{(36 - 4) \div 8 - 4}{4 \times 8 - 2 \times 16 + 1} \Rightarrow \frac{32 \div 8 - 4}{32 - 32 + 1} = \frac{(36 - 4) \div 8 - 4}{4 \times 8 - 2 \times 16 + 1} = \frac{4 - 4}{1} = 0$$

Q 47. If → stands for 'additions',← stands for 'subtraction', ↑ stands for 'division', ↓ stands for ,multiplication', ↗ stands for 'equal to', then which of the following alternatives is correct?

(a) 7 ← 43 ↑ 6 ↓ 1 ↗ 4 (b) 3 ↓ 6 ↑ 2→ 3 ← 6 ↗ 4

(c) 5 → 7 ← 3 ↑ 2 ↗ 4 **(d) 2 ↓ 5 ← 6 → 2 ↗ 6**

Explanation

Using the correct symbols we get expression given below

$2 \times 5 - 6 + 2 = 6$

Directions: In each of the following questions, various terms of an alphabet series are given with one or more terms missing as shown by – choose the missing terms out of the given alternatives.

Q 48. a c b _ c e _ f _

(a) dde (b) cde (c) dee (d) ddg

Explanation

Pattern follows as :- a (+2) c (+1) b (+2) $\boxed{d}$ *(+1) c (+2) e (+1)* $\boxed{d}$ *(+2) f (+1)* $\boxed{e}$.

Q 49. r t x_ s x_z_txy_ _yz

(a) y y r x s (b) y y s x r **(c) y y r s x** (d) y y x r s

Explanation

Pattern follows as :-

r t x y

s x y z

r t x y

s x y z

Q 50. Unscramble the letters to frame a meaningful word. Then find out the correct numerical position of the letters.

B	C	U	S	M	E	L	R	N	A
1	2	3	4	5	6	7	8	9	10

(a) 2 1 3 4 6 8 9 7 5 10 (b) 6 1 4 3 2 5 8 7 9 10 (c) 3 1 5 7 10 4 2 6 9 8 **(d) 3 9 4 2 8 10 5 1 7 6**

Explanation

After rearranging the alphabets the meaningful word that is formed - UNSCRAMBLE

Part – II : Elementary Mathematics

Q 51. The value of $\frac{\cos^2 60° + 4\sec^2 30° - \tan^2 45°}{\sin^2 30° + \cos^2 30°}$

(a) $\frac{64}{\sqrt{3}}$ **(b) $\frac{55}{12}$** (c) $\frac{67}{12}$ (d) $\frac{67}{10}$

Explanation

$$\frac{\cos^2 60° + 4\sec^2 30° - \tan^2 45°}{\sin^2 30° + \cos^2 30°}$$

$$= \frac{\left(\frac{1}{2}\right)^2 + 4\left(\frac{2}{\sqrt{3}}\right)^2 - 1^2}{1} \qquad [\because \cos^2\theta + \sin^2\theta = 1]$$

$$= \frac{\frac{1}{4} + 4 \times \frac{4}{3} - 1}{1}$$

$$= \frac{1}{4} + \frac{16}{3} - 1 = \frac{3 + 64 - 12}{12}$$

$$= \frac{67 - 12}{12} = \frac{55}{12}$$

Q 52. The expression $\frac{\tan 57° + \cot 37°}{\tan 33° + \cot 53°}$ is equal to

(a) tan 30° cot 57° **(b) tan 57° cot 37°** (c) tan 33° cot 53° (d) tan 33° cot 37°

Explanation

$$\frac{\tan 57° + \cot 37°}{\tan 33° + \cot 53°}$$

$$= \frac{\tan 57° + \cot 37°}{\tan (90° - 57°) + \cot (90° - 37°)}$$

$$= \frac{\tan 57° + \cot 37°}{\cot 57° + \tan 37°} \qquad \left[\begin{array}{l}\tan (90° - \theta) = \cot\theta \\ \cot (90° - \theta) = \tan\theta\end{array}\right]$$

$$= \frac{\tan 57° + \cot 37°}{\frac{1}{\tan 57°} + \frac{1}{\cot 37°}}$$

$$= \frac{\tan 57° + \cot 37°}{\frac{\cot 37° + \tan 57°}{\tan 57° \cot 37°}}$$

$$= \cancel{(\tan 57° + \cot 37°)} \times \frac{\tan 57° \cot 37°}{\cancel{(\cot 37° + \tan 57°)}}$$

$$= \tan 57° \cot 37°$$

Q 53. If $\frac{\sin\theta + \cos\theta}{\sin\theta - \cos\theta} = 3$ then the value of $\sin^4\theta$ is

(a) $\frac{16}{25}$ (b) $\frac{2}{3}$ (c) $\frac{1}{9}$ (d) $\frac{2}{9}$

Explanation

$$\frac{\sin\theta + \cos\theta}{\sin\theta - \cos\theta} = 3$$

Divide num & den. by cos θ

$$\frac{\frac{\sin\theta + \cos\theta}{\cos\theta}}{\frac{\sin\theta - \cos\theta}{\cos\theta}} = 3$$

$$\frac{\frac{\sin\theta}{\cos\theta}+\frac{\cos\theta}{\cos\theta}}{\frac{\sin\theta}{\cos\theta}-\frac{\cos\theta}{\cos\theta}}=3$$

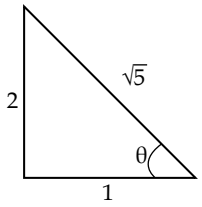
$$\frac{\tan\theta+1}{\tan\theta-1}=3$$

$\tan\theta+1 = 3(\tan\theta-1)$

$\tan\theta+1 = 3\tan\theta-3$

$1+3 = 3\tan\theta-\tan\theta$

$2\tan\theta = 4 \Rightarrow \tan\theta = \frac{2}{1}$



$\sin\theta = \frac{2}{\sqrt{5}}$

$\sin^4\theta = \frac{16}{25}$

Q 54. If $\sin - \cos = \theta\ \frac{7}{13}$ and $0°< \theta <90°$ then the value of $\sin\theta + \cos\theta$ is

(a) $\frac{17}{13}$ (b) $\frac{13}{17}$ (c) $\frac{1}{13}$ (d) $\frac{1}{17}$

Explanation

$\sin\theta - \cos\theta = \frac{7}{13}$

Squaring both sides

$(\sin\theta-\cos\theta)^2 = \left(\frac{7}{13}\right)^2 = \frac{49}{169}$

$\sin^2\theta+\cos^2\theta-2\sin\theta\cos\theta = \frac{49}{169}$

$1-2\sin\theta\cos\theta = \frac{49}{169}$

$1-\frac{49}{169} = 2\sin\theta\cos\theta$

$\frac{120}{169} = 2\sin\theta\cos\theta$

$(\sin\theta+\cos\theta)^2 = [\sin^2x+\cos^2x=1]$

$= \sin^2\theta+\cos^2\theta+2\sin\theta\cos\theta$

$= 1+\frac{120}{169} = \frac{289}{169}$

$(\sin\theta+\cos\theta)^2 = \left(\frac{17}{13}\right)^2 \Rightarrow \sin\theta+\cos\theta = \frac{17}{13}$

Q 55. If $a^2\sec^2x - b^2\tan^2x = c^2$ then the value of $\sec^2x + \tan^2x$ is equal to (assume $b2 \neq a^2$)

(a) $\frac{b^2-a^2+2c^2}{b^2+a^2}$ **(b) $\frac{b^2+a^2-2c^2}{b^2-a^2}$** (c) $\frac{b^2-a^2-2c^2}{b^2+a^2}$ (d) $\frac{b^2-a^2}{b^2+a^2+2c^2}$

Explanation

$a^2\sec^2x - b^2\tan^2x = c^2$

$a^2(1+\tan^2x) - b^2\tan^2x = c^2$

$[\sec^2\theta = 1+\tan^2\theta]$

$a^2+a^2\tan^2x - b^2\tan^2x = c^2$

$a^2-c^2 = b^2\tan^2x - a^2\tan^2x$

$a^2-c^2 = (b^2-a^2)\tan^2x$

$\tan^2x = \frac{a^2-c^2}{b^2-a^2}$

$\sec^2x = 1+\tan^2x = 1+\frac{a^2-c^2}{b^2-a^2}$

$= \frac{b^2-\cancel{a^2}+\cancel{a^2}-c^2}{b^2-a^2} = \frac{b^2-c^2}{b^2-a^2}$

$sec^2 x + tan^2 x = \frac{b^2 - c^2}{b^2 - a^2} + \frac{a^2 - c^2}{b^2 - a^2}$

$= \frac{b^2 + a^2 - 2c^2}{b^2 - a^2}$

Q 56. If $x + \frac{1}{x} = 5$, then is equal to $\frac{2x}{3x^2 - 5x + 3}$

(a) 5 **(b) $\frac{1}{5}$** (c) 3 (d) $\frac{1}{3}$

(b) $\frac{1}{5}$ *Explanation*

$x + \frac{1}{x} = 5$

$\frac{x^2 + 1}{x} = 5$ *or* $x^2 + 1 = 5x$ *... (1)*

$\frac{2x}{3x^2 - 5x + 3}$

$\frac{2x}{3x^2 - (x^2 + 1) + 3}$ *(using ... 1)*

$= \frac{2x}{3x^2 - x^2 - 1 + 3}$

$= \frac{2x}{2x^2 + 2}$

$= \frac{\cancel{2x}}{\cancel{2}(x^2 + 1)}$

$= \frac{\cancel{x}}{\cancel{5x}}$ *(using ... 1)*

$= \frac{1}{5}$

Q 57. The simplified value of $\left(1 - \frac{2xy}{x^2 - y^2}\right) \div \left(\frac{x^3 + y^3}{x - y} 3xy\right)$ is

(a) $\frac{1}{x^2 - y^2}$ **(b) $\frac{1}{x^2 + y^2}$** (c) $\frac{1}{x - y}$ (d) $\frac{1}{x + y}$

Explanation

$\left(1 - \frac{2xy}{x^2 + y^2}\right) \div \left(\frac{x^3 - y^3}{x - y} - 3xy\right)$

$\frac{x^2 + y^2 - 2xy}{x^2 + y^2} \div \frac{x^3 - y^3 - 3xy\,(x - y)}{x - y}$

$\frac{(x - y)^2}{x^2 + y^2} \div \frac{(x - y)^3}{x - y}$

$\frac{(x - y)^2}{x^2 + y^2} \times \frac{x - y}{(x - y)^3}$

$\frac{\cancel{(x - y)^3}}{(x^2 + y^2)\,\cancel{(x - y)^3}}$

$\frac{1}{x^2 + y^2}$

Q 58. Find the value of

$\frac{1}{5} + 999\frac{494}{495} \times 99$

(a) 90000 **(b) 99000** (c) 90900 (d) 99990

Explanation

$\frac{1}{5} + 999\frac{494}{495} \times 99$

$\frac{1}{5} + (999 + \frac{494}{495}) \times 99$

$\frac{1}{5} + 999 \times 99 + \frac{494}{\cancel{495}_{5}} \times \cancel{99}^{1}$

$\frac{1}{5} + \frac{494}{5} + 999 \times 99 = \frac{\cancel{495}^{99}}{\cancel{5}_{1}} + 999 \times 99$

$99 + 999 \times 99 = 99\ (1+999)$

$99 \times 1000 = 99000$

Q 59. If $x = 11$, then the value of $x^5 - 12x^4 - 12x^3 - 12x^2 + 12x - 1$ is

(a) 11 **(b) 10** (c) 12 (d) -10

Explanation

$x = 11$

$= x^5 - 12x^4 + 12x^3 - 12x^2 + 12x - 1$

$= 11^5 - 12 \times 11^4 + 12 \times 11^3 - 12 \times 11^2 + 12 \times 11 - 1$

$= 11^5 - (11+1)11^4 + (11+1)11^3 - (11+1)11^2 + (11+1) \times 11 - 1$

$= \cancel{11^5} - \cancel{11^5} - \cancel{11^4} + \cancel{11^4} + \cancel{11^3} - \cancel{11^3} - \cancel{11^2} + \cancel{11^2} + 11 - 1$

$= 11 - 1 = 10$

Q 60. If p = 101, then the value of $\sqrt[3]{p(p^2 - 3p + 3) - 1}$ is

(a) 100 (b) 101 (c) 1001 (d) 1000

Explanation

given $p = 101$

$= \sqrt[3]{p^3 - 3p^2 + 3p - 1}$

$= \sqrt[3]{p^3 - 1^3 - 3p\ (p - 1)}$

$(\because a^3 - b^3 - 3ab\ (a - b) = (a - b)^3)$

$= \sqrt[3]{(p-1)^3} = [(p-1)^{\cancel{3}}]^{\frac{1}{\cancel{3}}} = p - 1$

$= 101 - 1 = 100$

Q 61. If $a^{\frac{1}{3}} = 11$ then the value of $a^2 - 331a$ is

(a) 1331331 **(b) 1331000** (c) 1334331 (d) 1330030

Explanation

$a^{\frac{1}{3}} = 11$

Cubing both sides

$\Rightarrow a = 11^3 \Rightarrow a = 1331$

$a^2 - 331a \Rightarrow a\ (a - 331) = 1331\ (1331 - 331)$

$= 1331 \times 1000 = 1331000$

Q 62. If $11\sqrt{n} = \sqrt{112} + \sqrt{343}$ then the value of n is

(a) 3 (b) 11 (c) 13 **(d) 7**

Explanation

$11\sqrt{n} = \sqrt{112} + \sqrt{343}$

$11\sqrt{n} = \sqrt{7 \times 16} + \sqrt{7 \times 49}$

$11\sqrt{n} = 4\sqrt{7} + 7\sqrt{7}$

$11\sqrt{n} = 11\sqrt{7}$

$n = 7$ *[on comparing both sides]*

Q 63. If $x + y = \sqrt{3}$ and $x - y = \sqrt{2}$, then the value of $8xy\ (x^2 + y^2)$ is

(a) 6 (b) $\sqrt{6}$ **(c) 5** (d) $\sqrt{5}$

Explanation

$x + y = \sqrt{3}$ and $x - y = \sqrt{2}$,

then the value of $8xy\ (x^2 + y^2)$

$x + y = \sqrt{3}$

$x - y = \sqrt{2}$

Adding we get, $2x = \sqrt{3} + \sqrt{2}$

$x = \frac{\sqrt{3} + \sqrt{2}}{2}$ ... 1

Subtracting we get, $2y = \sqrt{3} - \sqrt{2}$

$y = \frac{\sqrt{3} - \sqrt{2}}{2}$ ... 2

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

$= \frac{3+2+2\sqrt{6}}{4} = \frac{5+2\sqrt{6}}{4}$ $[\because (a+b)^2 = a^2+b^2+2ab]$

$y^2 = \left(\frac{\sqrt{3}-\sqrt{2}}{2}\right)^2$

$= \frac{3+2-2\sqrt{6}}{4} = \frac{5-2\sqrt{6}}{4}$ $[\because (a-b)^2 = a^2+b^2-2ab]$

$x^2 + y^2 = \frac{5+2\sqrt{6}}{4} + \frac{5-2\sqrt{6}}{4} = \frac{10}{4} = \frac{5}{2}$

$xy = \left(\frac{\sqrt{3}+\sqrt{2}}{2}\right)\left(\frac{\sqrt{3}-\sqrt{2}}{2}\right)$

$= \frac{(\sqrt{3})^2-(\sqrt{2})^2}{4} = \frac{1}{4}$ $\left(using\ a^2-b^2 = (a+b)(a-b)\right)$

$\therefore 8xy(x^2+y^2) = \cancel{8}^{2} \times \frac{1}{\cancel{4}_{1}} \times \frac{5}{\cancel{2}} = 5$

Q 64. If $2^x = 3^y = 6^{-z}$ then $\left(\frac{1}{x}+\frac{1}{y}+\frac{1}{z}\right)$ is equal to

(a) 0 (b) 1 (c) $\frac{3}{2}$ (d) $-\frac{1}{2}$

Explanation

Let $2^x = 3^y = 6^{-z} = k$

$2 = k^{\frac{1}{x}}, 3 = k^{\frac{1}{y}}, 6 = k^{\frac{-1}{z}}$

$2 \times 3 = 6$

$k^{\frac{1}{x}} \times k^{\frac{1}{y}} = k^{\frac{-1}{z}}$

$k^{\frac{1}{x}+\frac{1}{y}} = k^{\frac{-1}{z}}$ $[\because a^m \times a^n = a^{m+n}]$

$\frac{1}{x}+\frac{1}{y} = \frac{-1}{z} \Rightarrow \frac{1}{x}+\frac{1}{y}+\frac{1}{z} = 0$

Q 65. If $x = 3 + \sqrt[2]{2}$ then $x^2 + \frac{1}{x^2}$ is equal to

(a) 36 (b) 30 (c) 32 **(d) 34**

Explanation

$x = 3+ 2\sqrt{2}$

$\frac{1}{x} = \frac{1}{3+2\sqrt{2}}$

$= \frac{1}{3+2\sqrt{2}} \times \frac{3-2\sqrt{2}}{3-2\sqrt{2}}$ *[on Rationalising]*

$= \frac{3-2\sqrt{2}}{9-8} = \frac{3-2\sqrt{2}}{1}$

$x^2 + \frac{1}{x^2} = \left(x+\frac{1}{x}\right)^2 - 2$

$= (3+2\cancel{\sqrt{2}}+3-2\cancel{\sqrt{2}})^2 - 2 = 6^2 - 2 = 36 - 2 = 34$

Q 66. The distance between two parallel chords of length 8 cm each in a circle of diameter 10 cm is

(a) 6 cm (b) 7cm (c) 8 cm (d) 5.5 cm

Explanation

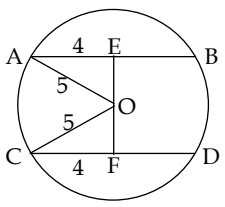
⊥ar from centre to the chord

bisects the chord $\therefore AE = EB = CF = FD = 4cm$

Also diameter = 10cm

$\therefore AO = OC = 5cm$ *(radii of the same circle)*

In ΔOCF, *by Pythagoras theorem,*



$OC^2 = OF^2 + CF^2$

$\therefore (5)^2 = OF^2 + (4)^2$ or $OF^2 = 25 - 16 = 9$

$\therefore OF = 3cm$

similarly, $OE = 3cm$ $EF = EO + OF = 6cm$

Q 67. ABCD is a rhombus. A straight line through C cuts AD produced at P and AB produced at Q. If $DP = \frac{1}{2}$ AB then the ratio of the length of BQ and AB is

(a) 2:1 (b) 1:2 (c) 1:1 (d) 3:1

Explanation

ABCD is a rhombus

$\therefore$ *CD || to BA*

$\therefore \angle 1 = \angle 2$ *(corresponding angles)*

$\angle P = \angle P$ *(common)*

$\therefore$ *By AA similarity,*

Δ *DPC is* Δ *APQ*

$\therefore$ *Ratio of corresponding sides is equal*

$$\therefore \frac{AP}{PD} = \frac{AQ}{DC}$$

$$\frac{AD + DP}{PD} = \frac{AB + BQ}{DC}$$

$$\Rightarrow \frac{AD}{DP} + \frac{AD}{DP} = \frac{AB}{DC} + \frac{BQ}{DC}$$

Given $DP = \frac{1}{2} AB = \frac{1}{2} AD$

($\because$ *ABCD is a rhombus*

$\therefore$ *AB = BC = CD = DA)*

$$\frac{AD}{\frac{1}{2}AD} + 1 = \frac{AB}{AB} + \frac{BQ}{AB}$$ *(replacing DC by AB)*

$$2 + 1 = 1 + \frac{BQ}{AB}$$

$$\text{or } \frac{BQ}{AB} = \frac{2}{1}$$

Q 68. If the sides of a triangle are in the ratio $3 : 1\frac{1}{4} : 3\frac{1}{4}$ then the triangle is

(a) Right triangle (b) Isosceles triangle (c) Obtuse triangle (d) Acute triangle

Explanation

Let the sides of the triangle be $3k, \frac{5}{4}k$ *and* $\frac{13}{4}k$

Now, $(3k)^2 + \left(\frac{5k}{4}\right)^2 = 9k^2 + \frac{25k^2}{16}$

$$= \frac{144k^2 + 25k^2}{16} = \frac{169k^2}{16} = \left(\frac{13k}{4}\right)^2$$

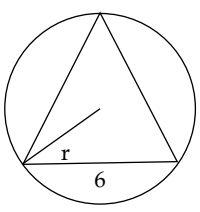
$\because$ *sum of squares of 2 sides is equal to square of the third side, by converse of Pythagoras theorem it is a right angled triangle.*

Q 69. An equilateral triangle of side 6 cm is inscribed in a circle. Then radius of the circle is:

(a) 2 $\sqrt{3}$ **cm** (b) 3 $\sqrt{2}$ cm (c) 4 $\sqrt{3}$ cm (d) $\sqrt{3}$ cm

Explanation

$$r = \frac{s}{\sqrt{3}} = \frac{6}{\sqrt{3}} = \frac{2 \times 3}{\sqrt{3}} = 2\sqrt{3}\ cm$$



Q 70. If the difference between compound interest and simple interest on a certain sum of money for 2 years at 8% per annum is Rs. 768/- then the sum invested is:

(a) 1,00,000/- (b) 1,10,000/- **(c) 1,20,000/-** (d) 1,70,000/-

Explanation

$S.I. = \frac{P \times R \times T}{100}$ $C.I. = \left(P\left(1 + \frac{R}{100}\right)^T - P\right)$

Where P = Principal, R = Rate of Interest ,

T = Time Period

$\therefore$ *given CI – SI = 768*

$$P\left[\left(1 + \frac{8}{100}\right)^2 - 1\right] - \frac{P \times 8 \times 2}{100} = 768$$

$$P\left[\left(1 + \frac{2}{25}\right)^2 - 1\right] - \frac{4P}{25} = 768$$

$$P\left[\left(\frac{27}{25}\right)^2 - 1 - \frac{4}{25}\right] = 768$$

$$P\left[\frac{27^2 - 25^2 - 4 \times 25}{25^2}\right] = 768$$

$$P = \frac{768 \times 25 \times 25}{(27^2 - 25^2) - 4 \times 25} = \frac{768 \times 25 \times 25}{52 \times 2 - 100} = \frac{\cancel{768}^{192} \times 25 \times 25}{\cancel{4}_{1}} = 1,20,000$$

Q 71. On what sum of money will the difference between simple interest and compound interest for 2 years at 5% per annum be equal to Rs. 63/-

(a) Rs. 24600/- (b) Rs. 24800/- **(c) Rs. 25200/-** (d) Rs. 25500/-

Explanation

$S.I. = \frac{P \times R \times T}{100}$ $C.I. = \left(P\left(1 + \frac{R}{100}\right)^T - P\right)$

Where P = Principal, R = Rate of Interest , T = Time Period

$$P\left[\left(1 + \frac{5}{100}\right) - 1\right] - \frac{P \times 5 \times 2}{100} = 63^2$$

$$P\left[\left(\frac{21}{20}\right)^2 - 1 - \frac{1}{10}\right] = 63$$

$$P\left[\frac{21^2 - 20^2}{20^2} - \frac{1}{10}\right] = 63$$

$$P\left[\frac{441 - 400}{400} - \frac{1}{10}\right] = 63$$

$$P\left[\frac{41}{400} - \frac{1}{10}\right] = 63$$

$$P\left(\frac{41 - 40}{400}\right) = 63 \Rightarrow P = 63 \times 400 = Rs\ 25,200$$

Q 72. A sells an article to B making a profit of $\frac{1}{5}$ of his outlay. B sells it to C, gaining 20%. If C sells it for Rs. 600 and incurs a loss of $\frac{1}{6}$ of his outlay, the cost price of A is

(a) Rs. 600 **(b) Rs. 500** (c) Rs. 720 (d) Rs. 800

Explanation

Let CP for A be Rs x

$\therefore SP = x + \frac{1}{5} \times x = \frac{6x}{5}$

$\therefore$ *CP of B* $= \frac{6x}{5}$ *and SP* $= \frac{6x}{5} + \frac{\cancel{20}^{1}}{\cancel{100}_{5}} \times \frac{6x}{5}$

$= \frac{6x}{5} + \frac{6x}{25} = \frac{36x}{25}$

$\therefore$ *CP of C* $= \frac{36x}{25}$ *its loss* $= \frac{1}{\cancel{6}_{1}} \times \frac{\cancel{36x}^{6}}{25} = \frac{6x}{5}$

$\therefore$ *SP of C* $= \frac{36x}{25} - \frac{6x}{5} = \frac{30x}{25}$

given $\frac{\cancel{30x}^{6}}{\cancel{25}_{5}} = 600$

$\frac{6x}{5} = 600$

$\therefore x = \frac{5 \times 600}{6} = Rs\ 500$

Q 73. Ramesh bought 10 cycles for Rs. 500 each. He spent Rs. 2,000 on the repair of all cycles. He sold five of them for Rs. 750 each and the remaining for Rs. 550 each. Then the total gain or loss % is

(a) Gain of $8\frac{1}{3}\%$ (b) Loss of $8\frac{1}{3}\%$ (c) Gain of $7\frac{2}{3}\%$ **(d) Loss of $7\frac{1}{7}\%$**

Explanation

CP of 10 cycles = 500 × 10 = 5000

Money spent on repair = Rs 2000

$\therefore$ *Total CP = 5000 + 2000 = Rs 7000*

SP of 5 cycles = 5 × 750 = 3750

SP of remaining 5 cycles = 5 × 550 = 2750

$\therefore$ *Total SP of 10 cycles = 3750 + 2750 = Rs 6500*

$\therefore$ *Loss = CP – SP = Rs 500*

Loss% $= \frac{Loss}{CP} \times 100 = \frac{\cancel{500}}{\cancel{7000}} \times \cancel{100}$

$= \frac{50}{7}\% = 7\frac{1}{7}\%$

Q 74. A can finish a piece of work in 18 days and B can do the same work in half of the time taken by A. Then working together what part of the same work they can finish in a day.

(a) $\frac{1}{6}$ (b) $\frac{2}{5}$ (c) $\frac{1}{9}$ (d) $\frac{2}{7}$

Explanation

Let total units of work = 18

Efficiency of A = 1

Efficiency of B = 2

No. of days to finish work $= \frac{18}{1+2} = \frac{\cancel{18}}{3} = 6$

Work done in 1 day $= \frac{1}{6}$

Q 75. The rate of working of A and B are in the ratio 2:3. The number of days taken by them to finish the work is in the ratio

(a) 2:3 (b) 4:9 **(c) 3:2** (d) 9:4

Explanation

Rate of working = 2:3

No. of days $= \frac{1}{2} : \frac{1}{3} = 3:2$

Q 76. The ratio of the number of boys and girls in the school is 3:2. If 20% of the boys and 25% of the girls are scholarship holders, the percentage of the school students who are not scholarship holders is

(a) 56 **(b) 78** (c) 70 (d) 80

Explanation

Let no. of boys be 3x and girls be 2x

$\therefore$ *20% of boys* $= \frac{20}{100} \times 3x = \frac{3x}{5}$

25% of girls $= \frac{25}{100} \times 2x = \frac{x}{2}$

Total no. of students = No. of (boys + girls) = 5x

Scholarship holders $= \frac{3x}{5} + \frac{x}{2}$

$= \frac{6x + 5x}{10} = \frac{11x}{10}$

$\therefore$ *Students who are not scholarship*

holders $= 5x - \frac{11x}{10} = \frac{50x - 11x}{10} = \frac{39x}{10}$

$\% = \frac{\frac{39x}{10}}{5x} \times 100 = \frac{39}{10 \times 5} \times \frac{2}{100} = 78\%$

Q 77. A train passes two bridges of lengths 800 m and 400 m in 100 seconds and 60 seconds respectively. The length of the Train is
(a) 80 m (b) 90 m **(c) 200 m** (d) 150 m

Explanation

Let length of the train be x m

$speed = \frac{distance\ covered}{time\ taken} = constant$

$\therefore$ *speed to cover distance of (800 + x)m = speed to cover distance of (400 + x)m*

$\therefore \frac{800 + x}{100} = \frac{400 + x}{60}$

$3 (800 + x) = 5 (400 + x)$

$2400 + 3x = 2000 + 5x$

or $3x - 5x = 2000 - 2400$

or $-2x = -400$

or $x = 200$ *m*

Q 78. In an examination, 52% students failed in Hindi and 42% in English. If 17% failed in both the subjects, what percentage of students passed in both the subjects?
(a) 38% (b) 33% **(c) 23%** (d) 18%

Explanation

$n (H \cup E) = n (H) + n (E) - n (H \cap E)$

$= 52\% + 42\% - 17\% = 94\% - 17\% = 77\%$

Passed in both subjects $= 100\% - 77\% = 23\%$

Q 79. The batting average for 40 innings of a cricket player is 50 runs. His highest score exceeds his lowest score by 172 runs. If these two innings are excluded, the average of the remaining 38 innings is 48 runs. The highest score of the player is
(a) 165 (b) 170 (c) 172 **(d) 174**

Explanation

Total score $= 40 \times 50 = 2000$

Let lowest $= l$

highest $= l + 172$

average of 38 innings $= 48$

Total of 38 innings $= 38 \times 48 = 1824$

$1824 + l + l + 172 = 2000$

$1996 + 2l = 2000$

$2l = 2000 - 1996$

$2l = 04 \quad l = 2$

highest $= l + 172 = 2 + 172 = 174$

Q 80. A discount of series of 15%, 20% and 30% is equal to a single discount of
(a) 50% (b) 47.6% (c) 52.8% **(d) 52.4%**

Explanation

Let initial price $=$ Rs 100

Ist *discount = 15% of 100 =* Rs 15

$\therefore$ *Remaining amount =* Rs 100 – Rs 15 = Rs 85

2nd *discount = 20% of Rs 85* $= \frac{20}{100} \times \frac{17}{85} = 17$

$\therefore$ *Remaining amount =* Rs 85 – Rs 17 = Rs 68

3^{rd} *discount = 30% of Rs 68* $= \frac{30}{100} \times 68 = Rs\ 20.40$

$\therefore$ *Remaining final amount = Rs 68 – Rs 20.40 = Rs 47.60*

Total discount = 15 + 17 + 20.4 = 52.4

or (100 – 47.6 = 52.4)

Single discount = 100% – 47.6% = 52.4%

Q 81. A dishonest dealer defrauds to the extent of x% in buying as well as selling his goods by using faulty weight. What will be the gain percent on his outlay?

(a) $2x\%$ (b) $(\frac{10}{x} + x^2)\%$ **(c) $(2x + \frac{x^2}{100})\%$** (d) $(x + \frac{x^2}{100})\%$

Explanation

Let CP in buying = Rs 100

$\because$ *gain = x %*

$\therefore$ *SP = (100 + x) Rs.*

In selling this SP becomes CP

$\therefore$ *CP = Rs (100 + x)*

gain = x%

$gain\ \% = \frac{gain}{CP} \times 100 = \frac{SP - CP}{CP} \times 100$

$x = \frac{SP - (100 + x)}{(100 + x)} \times 100$

$SP - (100 + x) = \frac{x\,(100 + x)}{100}$

$SP = \frac{x\,(100 + x)}{100} + (100 + x)$

$= (100 + x) \times \left[1 + \frac{x}{100}\right] = \frac{(100 + x)^2}{100}$

$overall\ gain\ \% = \frac{SP - CP}{CP} \times 100$

$= \frac{\frac{(100 + x)^2}{100} - 100}{\cancel{100}} \times \cancel{100}$

$= \frac{(100 + x)^2 - 10000}{100}$

$= \frac{10000 + x^2 + 200x - 10000}{100}$

$= \frac{x^2 + 200x}{100} = \left(2x + \frac{x^2}{100}\right)\%$

or short cut approach

$\left[x + x + \frac{x + x}{100} = 2x + \frac{x^2}{100}\%\right]$

Q 82. A and B started a business in the partnership by investing in the ratio of 7:9. After 3 months A withdraw $\frac{2}{3}$ of of its investment and after 4 months from the beginning B withdraw $33\frac{1}{3}$% of its investment. If the total earned profit is Rs. 10201/- at the end of 9 months, find the share of each in the profit.

(a) Rs 3535/- and Rs 6666/- (b) Rs 3055/- and Rs. 5555/-

(c) Rs 4503/- and Rs 1345/- (d) Rs 3545/- and Rs. 3333/-

Explanation

$7x \times 3 + \frac{7x}{\cancel{3}_1} \times \cancel{6}^{2} : 9x \times 4 + 30x$

$21x + 14x : 36x + 30x$

$35x : 66x$

$35\cancel{x} : 66\cancel{x}$

$A : B = 35 : 66$

$A's\ profit = \frac{35}{\cancel{101}_{1}} \times \overset{101}{\cancel{10201}} = 3535$

$B's\ profit = \frac{66}{\cancel{101}_{1}} \times \overset{101}{\cancel{10201}} = 6666$

Q 83. The mean marks of 20 students is 15. On checking it was found that two marks were wrongly copied as 3 and 6. If wrong marks obtained are replaced by correct values 8 and 4, then the correct mean is

(a) 15 **(b) 15.15** (c) 15.35 (d) 16

Explanation

Total marks = 20 × 15 = 300

Total correct marks = 300 – 3 – 6 + 8 + 4

= 300 + 12 – 9 = 303

Correct mean $= \frac{303}{20} = 15.15$

Q 84. Three circle of diameter 10 cm each are bound together by rubber band, the length of the rubber band is.

(a) 30 **(b) 30 + 10 π** (c) 10 π (d) 60 + 20 π

Explanation

30 + 2π × 5

30 + 10π

Q 85. A river 3 m deep and 40 m wide is flowing at the rate of 2 km per hour. How much water will fall into sea in a minute?

(a) 4,00,000 m^3 (b) 40,00,000 m^3 (c) 40,000 m^3 **(d) 4,000 m^3**

Explanation

Water flowed in 1 hour = 3 × 40 × 2000 = 24000 m^3 *[Volume of cuboid = lbh]*

Water flowed in 1 minute $= \frac{\overset{4000}{\cancel{240000}}}{\cancel{60}_{1}} = 4000\ m^3$ *(1 hour = 60 minutes)*

Q 86. If the radius of the base and the height of a right circular cylinder is increased by 10% each then the volume of the cylinder increases by:

(a) 3.31% (b) 14.5% **(c) 33.1%** (d) 19.5%

Explanation

Volume of cylinder $(V_1) = \pi r^2 h$

where r = radius of the base, h = height

new radius $= r + \frac{10}{100} \times r = \frac{11r}{10}$

new height $= h + \frac{10}{100} \times h = \frac{11h}{10}$

new volume $(V_2) = \pi \left(\frac{11r}{10}\right)^2 \left(\frac{11h}{10}\right)$

$= \frac{1331}{1000}\ \pi r^2 h$

% increase in volume

$= \frac{New\ Volume - Original\ Volume}{Original\ Volume} \times 100$

$\frac{V_2 - V_1}{V_1} \times 100$

$= \frac{\frac{1331}{1000}\pi r^2 h - \pi r^2 h}{\pi r^2 h} \times 100$

$= \frac{\left(\frac{1331}{1000} - 1\right)\pi r^2 h}{\pi r^2 h} \times 100$

$= \frac{1331 - 1000}{\cancel{1000}} \times \cancel{100} = \frac{331}{10} = 33.1\%$

Q 87. The amount of concrete required to build a concrete cylindrical pillar whose base has a perimeter 8.8 metre and curved surface area 17.6 sq. metre is (Take $\pi = \frac{22}{7}$)

(a) 8.325 m^3 (b) 9.725 m^3 (c) 10.5 m^3 **(d) 12.32 m^3**

Explanation

Perimeter of circle = $2\pi r = 8.8$ m ...1

$\Rightarrow 2 \times \frac{22}{7} \times r = 8.8$

$r = \frac{8.8 \times 7}{2 \times 22} = 1.4$ m

Also, curved surface area of cylinder = $2\pi rh = 17.6\ m^2$ ...2

Divide 2 by 1

we get $\frac{2\pi rh}{2\pi r} = \frac{17.6}{8.8}$ *or* $h = 2$ m

Volume of cylinder $= \pi r^2 h = \frac{22}{7} \times 1.4 \times 1.4 \times 2$

$= 12.32\ m^3$

Q 88. Some bricks are arranged in an area measuring 20 m^3. If the length, breadth and height of each brick is 25 cm, 12.5 cm and 8 cm respectively, then the number of bricks are:

(a) 6000 **(b) 8000** (c) 4000 (d) 10000

Explanation

No. of bricks $= \frac{\text{Total area covered}}{\text{Volume of 1 brick}}$

Total area covered $= 20m^3$

$[1m^3 = 1000000\ cm^3]$

$= 20 \times 1000000\ cm^3$

$\therefore$ *No. of bricks* $= \frac{20 \times 1000000}{25 \times 12.5 \times 8}$

$(\because Brick\ is\ a\ cuboid\ \&\ volume\ of\ cuboid = l \times b \times h)$

$= \frac{20 \times 1000000 \times 10}{25 \times 125 \times 8} = 8000$

Q 89. The length, breadth and height of a room is 5m, 4m and 3m respectively. Find the length of the largest bamboo that can be kept.

(a) 5 m (b) 60m (c) 7 m **(d) $5\sqrt{2}$ m**

Explanation

Largest bamboo = length of diagonal $= \sqrt{l^2 + b^2 + h^2}$

$= \sqrt{5^2 + 4^2 + 3^2} = \sqrt{25 + 16 + 9}$

$= \sqrt{50} = 5\sqrt{2}$ *m*

Q 90. A solid metallic spherical ball of diameter 6cm is melted and re-casted into a cone with diameter of the base as 12 cm. The height of the cone is

(a) 6 cm (b) 2 cm (c) 4 cm **(d) 3 cm**

Explanation

radius of spherical ball $= \frac{6}{2} = 3cm$

Volume of spherical ball $V_1 = \frac{4}{3}\pi r^3 = \frac{4}{3}\pi (3)^3 = 36\pi$

radius of cone $= \frac{12}{2}\ cm = 6cm$

Let height of cone of h cm

Volume of cone $V_2 = \frac{1}{3}\pi 6^2 h = \frac{1}{3}\pi \times 36h = 12\pi h$

Volume of spherical ball = Volume of cone formed

$V_1 = V_2$

$36\pi = 12\pi h$

$3 = h$

$h = 3\ cm$

Q 91. If the ratio of the diameter of two right circular cones of equal height be 3:4, then the ratio of their valume will be

(a) 3:4 **(b) 9:16** (c) 16:9 (d) 27:64

Explanation

Let the radii of right circular cones be 3r and 4r and height be h

$$\text{Ratio of volumes} = \frac{\frac{1}{3}\ \pi (3r)^2 \times h}{\frac{1}{3}\ \pi (4r)^2 \times h} = \frac{9}{16} = 9:16$$

Q 92. What is the value of $\log_2 (\log_3 81)$?

(a) 2 (b) 3 (c) 4 (d) 9

Explanation

$$\log_2 (\log_3 81) = \log_2 \left(\frac{\log 81}{\log 3}\right) = \log_2 \left(\frac{\log 3^4}{\log 3}\right)$$

$$\left(\because \log_n m = \frac{\log_e m}{\log_e n} \text{ and } \log_e x^n = n \log_e x\right)$$

$$= \log_2 \left(\frac{4 \cancel{\log 3}}{\cancel{\log 3}}\right)$$

$$= \log_2 4 = \frac{\log 4}{\log 2} = \frac{\log 2^2}{\log 2} = \frac{2 \cancel{\log 2}}{\cancel{\log 2}} = 2$$

Q 93. Find the value of $\frac{0.355 \times 0.5555 \times 2.025}{0.225 \times 1.775 \times 0.2222}$ is equal to

(a) 5.4 (b) 4.58 **(c) 4.5** (d) 5.45

Explanation

$$\frac{0.355 \times 0.5555 \times 2.025}{0.225 \times 1.775 \times 0.2222}$$

$$\frac{\cancel{355} \times \cancel{5555} \times \cancel{2025}}{\cancel{225} \times \cancel{1775} \times \cancel{2222}} = \frac{9}{2} = 4.5$$

Q 94. $(0.01024)^{1/5}$ is equal to

(a) 0.4 (b) 4.0 (c) 0.04 (d) 0.00004

Explanation

$$(0.01024)^{\frac{1}{5}}$$

$$= \left(\frac{1024}{100000}\right)^{\frac{1}{5}} = \left(\frac{4^5}{10^5}\right)^{\frac{1}{5}}$$

$$= \left[\left(\frac{4}{10}\right)^5\right]^{\frac{1}{5}} = \left(\frac{4}{10}\right)^{\cancel{5} \times \frac{1}{\cancel{5}}} = \frac{4}{10} = 0.4$$

$$\left[(a^m)^n = a^{m \times n}\right]$$

Q 95. The value of $(243)^{0.16} \times (243)^{0.04}$ is equal to

(a) 0.16 **(b) 3** (c) $\frac{1}{3}$ (d) 0.04

Explanation

$$(243)^{0.16} \times (243)^{0.04}$$

$$(243)^{0.16+0.04} = (243)^{0.20}$$

$$[\because x^a x^b = x^{a+b}]\ [(x^a)^b = x^{ab}]$$

$$= (243)^{\frac{20}{100}} = (243)^{\frac{1}{5}} = (3^5)^{\frac{1}{5}} = 3$$

Q 96. If a and b are two positive integer such that $a^2 - b^2 = 19$ then value of a is

(a) 19 (b) 20 (c) 9 **(d) 10**

Explanation

$a^2 - b^2 = 19$

$(a + b)(a - b) = 19 \times 1$

[19 is a prime number prime number has only two factors, 1 and itself]

$a + b = 19$ .... 1 $a - b = 1$ 2

adding (1) & (2)

$a + b = 19$

$a - b = 1$

$2a = 20$

$a = 10 \Rightarrow 10 + b = 19 \therefore b = 9$

Q 97. $\sqrt{(798)^2 + 0.404 \times 0.798 + (0.202)^2} + 1$ is equal to

(a) 0 **(b) 2** (c) 1 (d) 0.404

Explanation

$\sqrt{(0.798)^2 + 0.404 \times 0.798 + (0.202)^2} + 1$

$\sqrt{(0.798)^2 + 2 \times 0.202 \times 0.798 + (0.202)^2} + 1$

$= \sqrt{(0.798 + 0.202)^2} + 1$

$= 1 + 1 = 2$

Q 98. The sum of three consecutive odd natural numbers is 147. Then the middle number is

(a) 47 (b) 48 **(c) 49** (d) 51

Explanation

Let the 3 numbers be x, x + 2, x + 4

According to condition

$x + x + 2 + x + 4 = 147$

$= 3x + 6 = 147$

$= 3x = 141$

$x = \frac{141}{3}^{47}$

$x = 47$

$\therefore$ *Numbers are 47, 49 and 51* $\therefore$ *Middle no. = 49*

Q 99. A student was asked to find $\frac{5}{16}$ of a number. By mistake he found $\frac{5}{6}$ of that number and his answer was 250 more than the correct answer. Find the given number

(a) 300 **(b) 480** (c) 450 (d) 500

Explanation

Let the no. be x

given, $\frac{5}{6}x = \frac{5}{16}x + 250$

$\left(\frac{5}{6} - \frac{5}{16}\right)x = 250$

$5x\left(\frac{8-3}{48}\right) = 250$

$5x \times \frac{5}{48} = 250$

$x = \frac{250 \times 48}{25}^{10} = 480$

Q 100. The HCF and LCM of two numbers are 12 and 336 respectively. If one number is 84, then the other number is

(a) 48 (b) 36 (c) 72 (d) 96

Explanation

$HCF \times LCM = n_1 \times n_2$

[HCF × LCM = Product of two numbers]

$12 \times 336 = 84 \times n_2$

$n_2 = \frac{12 \times 336}{84}^{48} = 48$