

# NUMERICAL ABILITY

## Solutions

1. The roots of  $ax^2+bx+c=0$  are real and positive.  $a$ ,  $b$  and  $c$  are real. Then  $ax^2+b|x|+c=0$  has

- (a) no roots
- (b) 2 real roots
- (c) 3 real roots
- (d) 4 real roots

Solution: Option (d)

Explanation:

Let the positive roots be  $m$  and  $n$ . Now,  $-m$  and  $-n$  will also satisfy the equation  $a^2x+b|x|+c=0$  and hence we have 4 roots.

2. If  $(z + 1/z)^2 = 98$ , compute  $(z^2 + 1/z^2)$ .

Solution: 96

Explanation:

$$(z+1/z)^2 = (z^2+2(z)(1/z) + (1/z)^2) = (z^2 + 1/z^2) = (z^2 + 1/z^2) + 2 = 98 \rightarrow 98 - 2 = 96$$

3. Round-trip tickets to a tourist destination are eligible for a discount of 10% on the total fare. In addition, groups of 4 or more get a discount of 5% on the total fare. If the one way single person fare is Rs 100, a group of 5 tourists purchasing round-trip tickets will be charged Rs \_\_\_\_\_.

Solution: Rs.850

Explanation:

For individual, Round-trip discount 10% on Total fare. So for each person  $(200 \times 10\%) = 20$ . So, for 5 member 100 rupees.

For 5 member group they will get 5% discount on Total fare i.e.  $(5 \times 200 \times 5\%) = 50$  rupees. Total discount is  $(100+50) = 150$ . They have to pay 850 rupees.

4. In a survey, 300 respondents were asked whether they own a vehicle or not. If yes, they were further asked to mention whether they own a car or scooter or both. Their responses are tabulated below. What percent of respondents do not own a scooter?

		Men	Women
Own vehicle	Car	40	34
	Scooter	30	20
	Both	60	46
Do not own vehicle		20	50

Solution: 48%

Explanation:

Not having scooter from Men (40(car owner) + 20 (nothing owns)) = 60

Not having scooter from Women (34 (care owner) + 50 (nothing owns)) = 84

Percentage =  $(60+84)/300 = .48$  i.e. 48%

5. When a point inside of a tetrahedron (a solid with four triangular surfaces) is connected by straight lines to its corners, how many (new) internal planes are created with these lines?

(a) 6

(b) 8

(c) 4

(d) 10

Solution: (a)

Explanation:

Tetrahedron has 4 corners, hence it forms 4 planes. If we add a point inside a tetrahedron, it makes a total of 5 points. Now, if we take the internal point and connect it with any two of corners of the tetrahedron, we get 1 internal plane.

So, any two combinations of the corners with the internal point gives an internal plane.

$\therefore {}^4C_2 = 6$  Internal planes.

6. A tourist covers half of his journey by train at 60 km/h, half of the remainder by bus at 30 km/h and the rest by cycle at 10 km/h. The average speed of the tourist is km/h during his entire journey is

(a) 36

(b) 30

(c) 24

(d) 18

Solution: Option (c)

Explanation:

Let the total distance be D then

avg speed = D/total time taken

Total time taken =  $D/2 \times 60 + D/4 \times 30 + D/4 \times 10$

avg speed =  $120/5 = 24$

7. The current erection cost of a structure is Rs.13,200. If the labour wages per day increase by  $1/5$  of the current wages and the working hours decrease by  $1/24$  of the current period, then the new cost of erection in Rs. is

(a) 16,500

(b) 15,180

(c) 11,000

(d) 10,120

Solution: Option (b)

Explanation:

Since wages per day increase by  $1/5$  of current wages, new wages per day becomes  $6/5$  of current wages.

Similarly new working hours are  $23/24$  of current working hours.

So new erection cost becomes  $13200 \times 6/5 \times 23/24 = 15180$ .

So option (b) is correct.

8. What is the average of all multiples of 10 from 2 to 198?

(a) 90

(b) 100

(c) 110

(d) 120

Solution: (a)

Explanation:

From 2 to 198 there are 19 multiples of 10.

These are 10, 20, 30, ..., 180, 190.

This is an A.P series, whose sum is  $\frac{n}{2}(a_1 + a_N)$ , where  $a_1$  and  $a_N$  are the 1st and last terms respectively.

Putting in the formula,

$a_1 = 10, a_N = 190$ .

$$\text{Sum} = \frac{19}{2}(10 + 190) = 1900$$

$$\text{Average} = \frac{\text{Sum of multiples}}{\text{Total number of multiples}} = \frac{1900}{19} = 100$$

9. The value of  $\sqrt{12 + \sqrt{12 + \sqrt{12 + \dots}}}$  is

(a) 3.464

(b) 3.932

(c) 4.000

(d) 4.444

Solution: Option (c)

Explanation:

$$x = \sqrt{12 + x}$$

$$\Rightarrow x^2 = 12 + x$$

$$\Rightarrow x^2 - x - 12 = 0$$

$$\Rightarrow (x - 4)(x + 3) = 0$$

$$\Rightarrow x = 4 \text{ or } x = -3$$

10. Which number does not belong in the series below?

2, 5, 10, 17, 26, 37, 50, 64

(a) 17

(b) 37

(c) 50

(d) 64

Solution: (d)

Explanation:

Given series is 2, 5, 10, 17, 26, 37, 50, 64.

For the first 7 terms, we can observe the relationship

$$A(n) = [A(n - 1) - \{A(n - 1) + A(n - 2)\} + 2] \text{ where } n \geq 3$$

Now for the 8th term i.e. A(8), this relationship violates.

According to the relationship,

$$A(8) = [A(7) + \{A(7) - A(6)\} + 2]$$

$$= [50 + \{50 - 37\} + 2]$$

$$= 50 + 13 + 2$$

$$= 65.$$

But in the series it is 64. Hence 64 doesn't belong to the series.

11. Consider the equation:

$$(7526)_8 - (Y)_8 = (4364)_8, \text{ where } (X)_N \text{ stands for } X \text{ to the base } N. \text{ Find } Y.$$

(a) 1634

(b) 1737

(c) 3142

(d) 3162

Solution: Option (c)

Explanation:

The given numbers are in octal representation. Digits range from 0 to 7.

$$Y = 7526 - 4364$$

7526

-4364

-----

3142

steps: 1.  $(6-4) = 2$

2.  $(2-6)$ , borrow a 8. Now  $(8+2-6) = 4$

3.  $(5-1-3) = 1$  (Subtracted by 1 because ONE 8 was borrowed)

4.  $(7-4) = 3$

12. If  $\log(P) = (1/2) \log(Q) = (1/3) \log(R)$ , then which of the following options is TRUE?

(a)  $P^2 = Q^3 R^2$

(b)  $Q^2 = PR$

(c)  $Q^2 = R^3 P$

(d)  $R = P^2 Q^2$

Solution: (b)

Explanation:

$$\text{Let } \log P = \frac{1}{2} \log Q = \frac{1}{3} \log R = C$$

Let the base of log be B

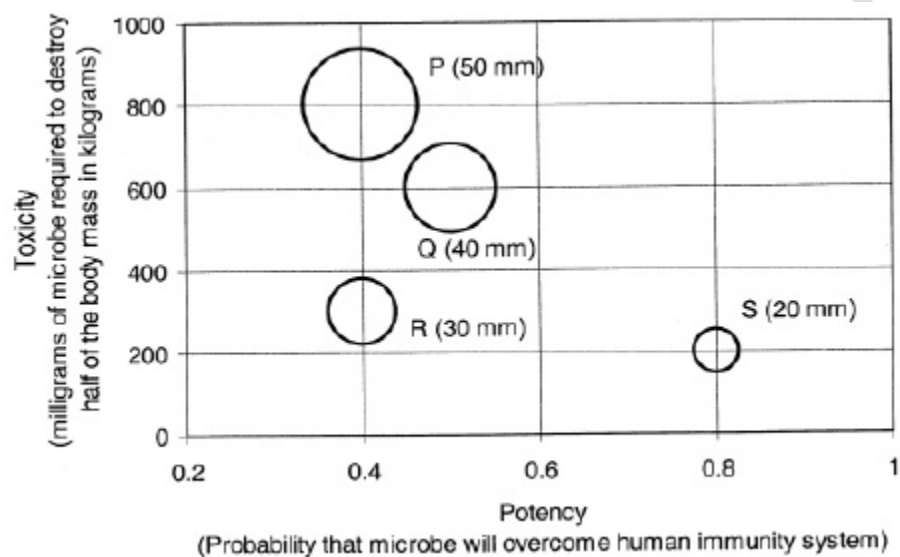
$$P = B^C$$

$$Q = B^{2C}$$

$$R = B^{3C}$$

which means  $Q^2 = PR$

**13.** P, Q, R and S are four types of dangerous microbes recently found in a human habitat. The area of each circle with its diameter printed in brackets represents the growth of a single microbe surviving human immunity system within 24 hours of entering the body. The danger to human beings varies proportionately with the toxicity, potency and growth attributed to a microbe shown in the figure below:



A pharmaceutical company is contemplating the development of a vaccine against the most dangerous microbe. Which microbe should the company target in its first attempt?

- (a) P (b) Q  
(c) R (d) S

Solution: Option (d)

Explanation:

As per the question, it is quite clear that the danger of a microbe to human being will be directly proportional to potency and growth. At the same time it is inversely proportional to toxicity, defined as (more dangerous will a microbe be if lesser of its milligram is required).

So,

$$\begin{aligned} \text{Level of Danger (D)} &\propto \text{Growth (G)} \\ &\propto \text{Potency (P)} \\ &\propto \text{Toxicity (T)} \end{aligned}$$

$$D = KGP/T$$

where K is constant of proportionality.

So level of danger will be maximum for S.

Given by,

$$\begin{aligned} D_s &= 0.8 * \pi(10)^2/200 \\ &= 1.256 \end{aligned}$$

Similar Calculations for  $D_p$ ,  $D_Q$ ,  $D_R$  can be done. Which will consequently, lead to  $D_s$  being the most dangerous and hence will be targeted first.

**14.** A transporter receives the same number of orders each day. Currently, he has some pending orders (backlog) to be shipped. If he uses 7 trucks, then at the end of the 4<sup>th</sup> day he can clear all the orders. Alternatively, if he uses only 3 trucks, then all the orders are cleared at the end of the 10<sup>th</sup> day. What is the minimum number of trucks required so that there will be no pending order at the end of 5<sup>th</sup> day?

(a) 4

(b) 5

(c) 6

(d) 7

Solution: Option (c)

Explanation:

Let the amount of orders received per day be x and let the amount of pending orders be y and let the amount of orders carried by a truck each day be z.

$$7z * 4 = 4x + y \rightarrow (1)$$

$$3z * 10 = 10x + y \rightarrow (2)$$

$$(2) - (1) \Rightarrow 2z = 6x, z = 3x, y = 80x$$

We want to find the number of trucks to finish the orders in 5 days. Let it be A.

$$Az * 5 = 5x + y$$

$$15Ax = 5x + 80x$$

$$A = 85/15 = 17/3 = 5.67$$

So, minimum 6 trucks must be used.

**15.** A container originally contains 10 litres of pure spirit. From this container 1 litre of spirit replaced with 1 litre of water. Subsequently, 1 litre of the mixture is again replaced with 1 litre of water and this process is repeated one more time. How much spirit is now left in the container?

- (a) 7.58 litres  
(c) 7 litres

- (b) 7.84 litres  
(d) 7.29 litres

Solution: Option (d)

Explanation:

Quantity left after  $n$  operations  $= x(1 - y/x)^n$

where  $x$  = initial quantity

$y$  = amount of mixture withdrawn each time (this should be same every time)

$n$  = no. of times operation performed

$$= 10(1 - 1/10)^n = 10(9/10)^3 = 10 \cdot 0.9 \cdot 0.9 \cdot 0.9 = 10 \cdot 0.729 = 7.29 \text{ litres}$$

Hence option D is correct.

**16.** The cost function for a product in a firm is given by  $5q^2$ , where  $q$  is the amount of production. The firm can sell the product at a market price of Rs.50 per unit. The number of units to be produced by the firm such that the profit is maximized is

- (a) 5  
(c) 15
- (b) 10  
(d) 25

Solution: (a)

Explanation:

$$\begin{aligned} \text{Profit} &= \text{Price} - \text{Cost} \\ &= 50q - 5q^2 \end{aligned}$$

To find the value of  $q$  at which the profit is maximum, we follow differentiation method.

$$\text{First derivative} = 50 - 10q$$

$$\begin{aligned} \text{Second derivative} &= -10 < 0 \Rightarrow \text{the expression is maximum at } q \text{ where first derivative is } 0 \\ \Rightarrow 50 - 10q &= 0 \Rightarrow q = 5 \end{aligned}$$

The value of above expression is maximum at  $q = 5$ .

**17.** A political party orders an arch for the entrance to the ground in which the annual convention is being held. The profile of the arch follows the equation  $y = 2x - 0.1x^2$  where  $y$  is the height of the arch in meters. The maximum possible height of the arch is



- (a) 8 meters  
(c) 12 meters

- (b) 10 meters  
(d) 14 meters

Solution: (b)

Explanation:

$$y = 2x - 0.1x^2$$

$$\frac{dy}{dx} = 2 - 0.2x$$

$$\frac{d^2y}{dx^2} < 0$$

$$\therefore y \text{ maximises at } 2 - 0.2x = 0 \Rightarrow x = 10$$

$$\text{So, } y = 20 - 10 = 10 \text{ meters}$$

**18.** An automobile plant contracted to buy shock absorbers from two supplies X and Y. X supplies 60% and Y supplies 40% of the shock absorbers. All shock absorbers are subjected to a quality test. The ones that pass the quality test are considered reliable. Of X's shock absorbers, 96% are reliable. Of Y's shock absorbers, 72% are reliable.

The probability that a randomly chosen shock absorber, which is found to be reliable, is made by Y is

- (a) 0.288  
(c) 0.667

- (b) 0.334  
(d) 0.720

Solution: Option (b)

Explanation:

$$\begin{aligned} \text{Probability of Y given R} &= \frac{\text{Probability of Y and R}}{\text{Probability of R}} \\ &= \frac{0.4 \times 0.72}{0.4 \times 0.72 + 0.6 \times 0.96} = \frac{1}{3} = 0.33 \end{aligned}$$

**19.** Which of the following assertions are CORRECT?

P: Adding 7 to each entry in a list adds 7 to the mean of the list

Q: Adding 7 to each entry in a list adds 7 to the standard deviation of the list

R: Doubling each entry in a list doubles the mean of the list

S: Doubling each entry in a list leaves the standard deviation of the list unchanged

(a) P, Q

(b) Q, R

(c) P, R

(d) R, S

Solution: Option (c)

Explanation:

Suppose we double each entry of a list

$$\text{Initial Mean}(M_I) = \frac{\sum_{i=1}^n x_i}{n}$$

$$\text{New Mean}(M_N) = \frac{\sum_{i=1}^n 2 \times x_i}{n} = \frac{2}{n} \sum_{i=1}^n x_i$$

So, when each entry in the list is doubled, mean also gets doubled.

$$\text{Standard Deviation } \sigma_I = \sqrt{\sum_{i=1}^n (M_I - x_i)^2}$$

$$\text{New Standard Deviation } \sigma_N = \sqrt{\sum_{i=1}^n (M_N - 2 \times x_i)^2}$$

$$= \sqrt{\sum_{i=1}^n (2 \times (M_I - x_i))^2}$$

$$= 2\sigma_I$$

So, when each entry is doubled, standard deviation also gets doubled.

When we add a constant to each element of the list, it gets added to the mean as well. This can be seen from the formula of mean.

When we add a constant to each element of the list, the standard deviation (or variance) remains unchanged. This is because, the mean also gets added by the same constant and hence the deviation from the mean remains the same for each element.

So, here P and R are correct.

**20.** Given the sequence of terms, AD CG FK JP, the next term is

- |        |        |
|--------|--------|
| (a) OV | (b) OW |
| (c) PV | (d) PW |

Solution: Option (a)

Explanation:

AD – difference 2 (B,C)

CG – difference 3 (D,E,F)

FK – difference 4 and JP – difference 5

so next term will have 6 difference

again each term starts with preceding term's 2<sup>nd</sup> last letter

so JKLMNOP, next term will start with O and having 6 difference it will be OV.

**21.** 25 persons are in a room. 15 of them play hockey, 17 of them play football and 10 of them play both hockey and football. Then the number of persons playing neither hockey nor football is:

- |        |        |
|--------|--------|
| (a) 2  | (b) 17 |
| (c) 13 | (d) 3  |

Solution: Option (d)

Explanation:

No. of persons who play either football or hockey =  $15 + 17 - 10 = 22$

No. of persons playing neither hockey nor football =  $25 - 22 = 3$

**22.** If  $137 + 276 = 435$  how much is  $731 + 672$ ?

- |          |          |
|----------|----------|
| (a) 534  | (b) 1403 |
| (c) 1623 | (d) 1513 |

Solution: Option (c)

Explanation:

$(137)_8 + (276)_8 = (435)_8$

So basically the numbers are given in Octal base.

Similarly, addition of 731,672 gives 1623 in octal.

**23.** 5 skilled workers can build a wall in 20 days; 8 semi-skilled workers can build a wall in 25 days; 10 unskilled workers can build a wall in 30 days. If a team has 2 skilled, 6 semi-skilled and 5 unskilled workers, how long it will take to build the wall?

- (a) 20 days (b) 18 days  
(c) 16 days (d) 15 days

Solution: Option (d)

Explanation:

1 skilled person can do  $\frac{1}{20}$  of work in 1 day, so 2 skilled person do  $\frac{2}{20}$  of work in a day. Similarly, 6 semi-skilled and 5 unskilled person can do  $\frac{6}{25}$  and  $\frac{5}{30}$  respectively in 1 day.

so they do  $\frac{1}{15}$  of work together in 1 day, which gives required number of day to complete the work = 15.

**24.** You are given three coins: one has heads on both faces, the second has tails on both faces, and the third has a head on one face and a tail on the other. You choose a coin at random and toss it, and it comes up heads. The probability that the other face is tails is

- (a)  $\frac{1}{4}$  (b)  $\frac{1}{3}$   
(c)  $\frac{1}{2}$  (d)  $\frac{2}{3}$

Solution: Option (b)

**25.** Given Set A = {2, 3, 4, 5} and Set B = {11, 12, 13, 14, 15}, two numbers are randomly selected, one from each set. What is the probability that the sum of the two numbers equals 16?

- (a) 0.20 (b) 0.25  
(c) 0.30 (d) 0.33

Solution: (a)

Explanation:

There are 20 possible pairs from {2, 3, 4, 5} and {11, 12, 13, 14, 15} i.e  $5 \times 4 = 20$ , out of which following pairs have sum 16.

(2, 14), (3, 13), (4, 12), (5, 11)

Therefore option (a) is correct

**26.** Based on the given statements, select the most appropriate option to solve the given question.

If two floors in a certain building are 9 feet apart, how many steps are there in a set of stairs that extends from the first floor to the second floor of the building?

Statements:

(I) Each step is  $\frac{3}{4}$  foot high.

(II) Each step is 1 foot wide.

- (a) Statement I alone is sufficient, but statement II alone is not sufficient.
- (b) Statement II alone is sufficient, but statement I alone is not sufficient.
- (c) Both statements are sufficient, but neither statement alone is sufficient.
- (d) Statements I and II together are not sufficient.

Solution: Option (a)

Explanation:

When we climb from one floor to the other, it is the height that matters and not the width of the staircase.

Therefore, from statement 1, we can figure out that  $9 / (\frac{3}{4})$  or 12 steps are required. Statement II is not sufficient.

**27.** The number of students in a class who have answered correctly, wrongly, or not attempted each question in an exam, are listed in the table below. The marks for each question are also listed. There is no negative or partial marking.

Q No.	Marks	Answered Correctly	Answered Wrongly	Not Attempted
1	2	21	17	6
2	3	15	27	2
3	1	11	29	4
4	2	23	18	3
5	5	31	12	1

What is the average of the marks obtained by the class in the examination?

- (a) 2.290
- (b) 2.970
- (c) 6.795
- (d) 8.795

Solution: Option (c)

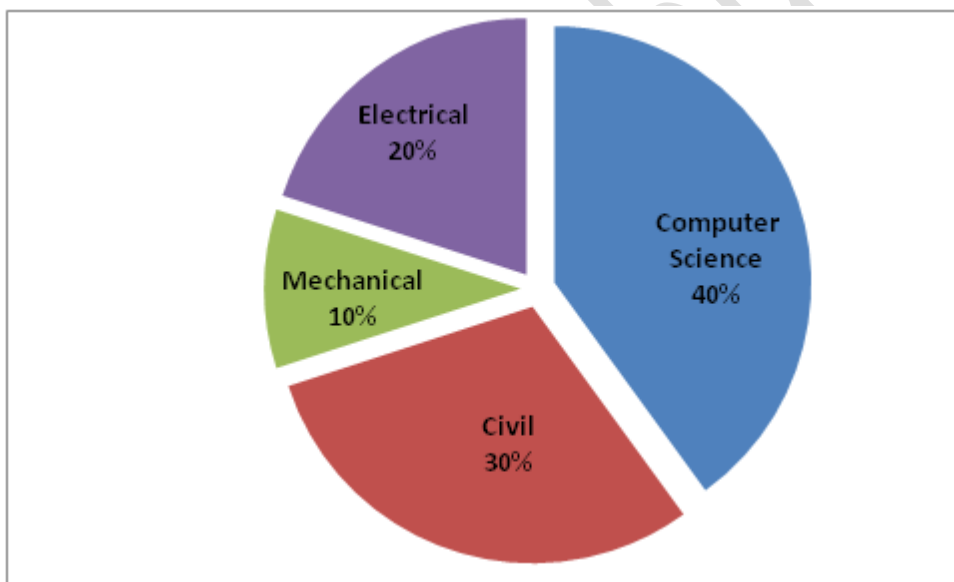
Explanation:

There are total 44 students. This count can be obtained by adding last 3 entries of any row of given total.

$$\begin{aligned}\text{Total marks} &= 2*21 + 3*15 + 1*11 + 2*23 + 5*31 \\ &= 299\end{aligned}$$

$$\text{Average marks} = 299/44 = 6.795$$

**28.** The pie chart below has the breakup of the number of students from different departments in an engineering college for the year 2012. The proportion of male to female students in each department is 5:4. There are 40 males in Electrical Engineering. What is the difference between the numbers of female students in the civil department and the female students in the Mechanical department?



Solution: 32

Explanation:

$$\text{Number of female students in Electrical} = 40 * \frac{4}{5} = 32$$

Number of female students in Civil =  $32 * \frac{30}{20} = 48$  (Since proportion of male to female students is same, the breakup chart is the same for number of female students)

$$\text{Number of female students in Mechanical} = 32 * \frac{10}{20} = 16$$

So, answer =  $48 - 16 = 32$

**29.** The probabilities that a student passes in mathematics, physics and chemistry are  $m$ ,  $p$  and  $c$  respectively. Of these subjects, the students has 75% chance of passing in at least one, a 50% chance of passing in at least two and a 40% chance of passing in exactly two. Following relations are drawn in  $m$ ,  $p$ ,  $c$ :

- I.  $p + m + c = 27/20$
- II.  $p + m + c = 13/20$
- III.  $(p) \times (m) \times (c) = 1/10$

- (a) Only relation I is true.
- (b) Only relation II is true.
- (c) Relations II and III are true.
- (d) Relations I and III are true.

Solution: Option (d)

Explanation:

$$\begin{aligned} 1 - (1 - m)(1 - p)(1 - c) &= 0.75 & \text{--- (1)} \\ (1 - m)pc + (1 - p)mc + (1 - c)mp + mpc &= 0.5 & \text{--- (2)} \\ (1 - m)pc + (1 - p)mc + (1 - c)mp &= 0.4 & \text{--- (3)} \end{aligned}$$

From last 2 equations, we can derive  $mpc = 0.1$  (Relation III is true)

After simplifying equation 1, we get.

$$\begin{aligned} p + c + m - (mp + mc + pc) + mpc &= 0.75 \\ p + c + m - (mp + mc + pc) &= 0.65 & \text{-----(4)} \end{aligned}$$

After simplifying equation 3, we get

$$pc + mc + mp - 3mpc = 0.4$$

Putting value of  $mpc$ , we get

$$pc + mc + mp = 0.7$$

After putting above value in equation 4, we get

$$\begin{aligned} p + c + m - 0.7 &= 0.65 \\ p + c + m &= 1.35 = 27/20 \text{ (Relation I is true)} \end{aligned}$$

**30.** Based on the given statements, select the most appropriate option to solve the given question.

What will be the total weight of 10 poles each of same weight?

Statements:

- I. One fourth of the weight of the pole is 5 Kg.
- II. The total weight of these poles is 160 Kg more than the total weight of two poles.

- (a) Statement I alone is not sufficient.
- (b) Statement II alone is not sufficient.
- (c) Either I or II alone is sufficient.
- (d) Both statements I and II together are not sufficient.

Solution: Option (c)

Explanation:

(I) is sufficient. We can determine total weight of 10 poles as  $10 * 4 * 5 = 200$  Kg

(II) is also sufficient, we can determine the weight.

Let x be the weight of 1 pole.

$$10*x - 2*x = 160 \text{ Kg}$$

$$x = 20 \text{ Kg}$$

$$10x = 200 \text{ Kg}$$

**31.** If ROAD is written as URDG, then SWAN should be written as:

- (a) VXDQ
- (b) VZDQ
- (c) VZDP
- (d) UXDQ

Solution: Option (b)

Explanation:

Every letter is replaced by third letter in alphabetical order.

**32.** A function  $f(x)$  is linear and has a value of 29 of  $x = -2$  and 39 at  $x = 3$ . Find its value at  $x = 5$ .

- (a) 59
- (b) 45
- (c) 43
- (d) 35

Solution: Option (c)



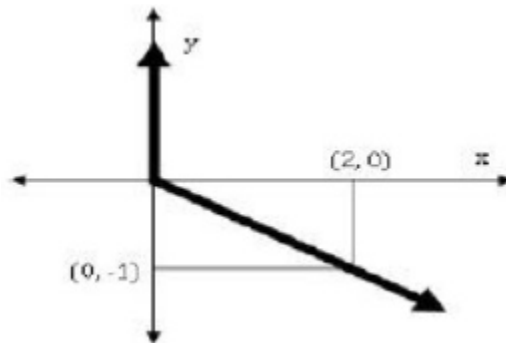
Explanation:

$f(x)$  is linear means it is of the form  $ax+b$

Given  $f(-2)$  and  $f(3)$

Solve the equation and find out value for  $a$  and  $b$ . Then find  $f(5)$ . It will be 43.

**33.** Choose the most appropriate equation for the function drawn as thick line, in the plot below.



(a)  $x = y - |y|$

(b)  $x = -(y - |y|)$

(c)  $x = y + |y|$

(d)  $x = -(y + |y|)$

Solution: Option (b)

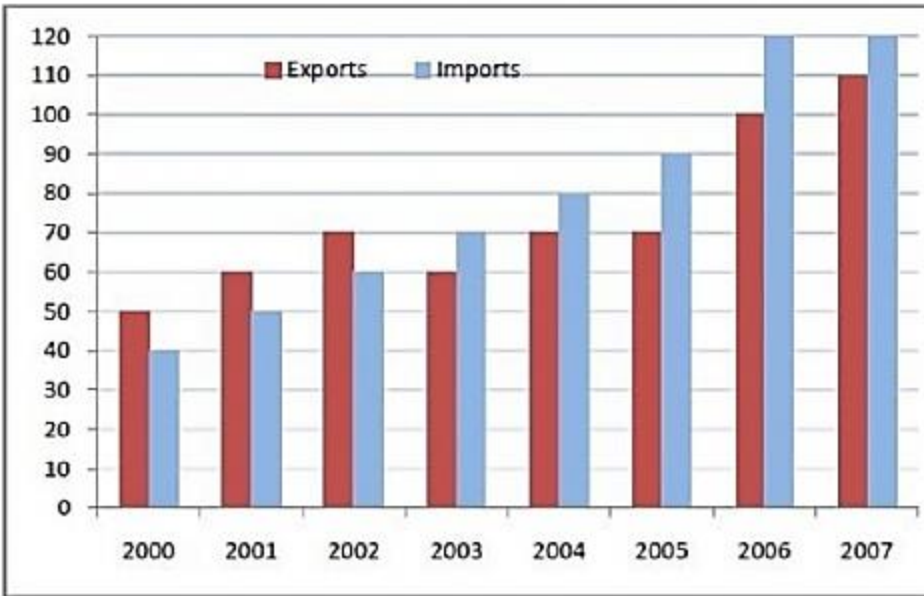
Explanation:

When  $y$  is  $-1$ ,  $x$  is  $2$ .

When  $y$  is positive  $x$  is  $0$ .

So,  $x = -(y - |y|)$

**34.** The exports and imports (in crores of Rs.) of a country from the year 2000 to 2007 are given in the following bar chart. In which year is the combined percentage increases in imports and exports the highest?



(a) 2004

(b) 2005

(c) 2006

(d) 2007

Solution: Option (c)

Explanation:

In 2006 export increased from 70 to 100 and import increased from 90 to 120.

% increase in import =  $30/70 = 42.8\%$

% increase in export =  $30/90 = 33.33\%$

Combined % increase in 2006 is more than any other year.

**35.** A function  $f(x)$  is linear and has a value of 29 at  $x = -2$  and 39 at  $x = 3$ . Find its value at  $x = 5$ .

(a) 59

(b) 45

(c) 43

(d) 35

Solution: Option (c)

Explanation:

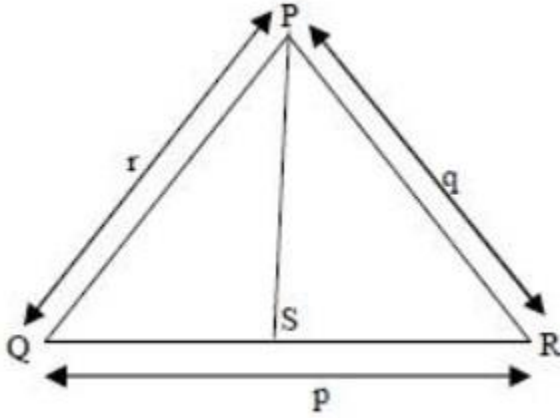
Given  $f(x)$  is linear, meaning that it is of the form  $ax + b$ .

$$f(-2) = 29 \rightarrow -2a + b = 29$$

$$f(3) = 39 \rightarrow 3a + b = 39$$

Find  $a$  and  $b$  by solving these two equations. We get  $f(5) = 43$

36. In a triangle PQR, PS is the angle bisector of  $\angle QPR$  and  $\angle QPS = 60^\circ$ . What is the length of PS?



(a)  $\frac{q+r}{qr}$

(b)  $\frac{qr}{q+r}$

(c)  $\sqrt{(q^2 + r^2)}$

(d)  $\frac{(q+r)^2}{qr}$

Solution: Option (b)

Explanation:

From the Angle Bisector theorem,

$$\frac{QS}{SR} = \frac{r}{q}$$

$$\frac{QS}{(p - QS)} = \frac{r}{q} \Rightarrow QS = \frac{pr}{r + q} \rightarrow (a)$$

We know that in a triangle,

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

Therefore in triangle PQS,  $\frac{QS}{\sin 60} = \frac{PS}{\sin Q}$

$$PS = QS \times \frac{\sin Q}{\sin 60} \rightarrow (b)$$

From triangle PQR,  $\frac{P}{\sin 120} = \frac{q}{\sin Q}$

$$p = q \times \frac{\sin 120}{\sin Q} = q \cdot \frac{\sin 60}{\sin Q} \rightarrow (c)$$

From (a), (b) and (c), we get  $PS = \frac{qr}{q+r}$

**37.** The table below has question-wise data on the performance of students in an examination. The marks for each question are also listed. There is no negative or partial marking in the examination.

Q.No	Marks	Answered Correctly	Answered Wrongly	Not Attempted
1	2	21	17	6
2	3	15	27	2
3	2	23	18	3

What is the average of the marks obtained by the class in the examination?

(a) 1.34

(b) 1.74

(c) 3.02

(d) 3.91

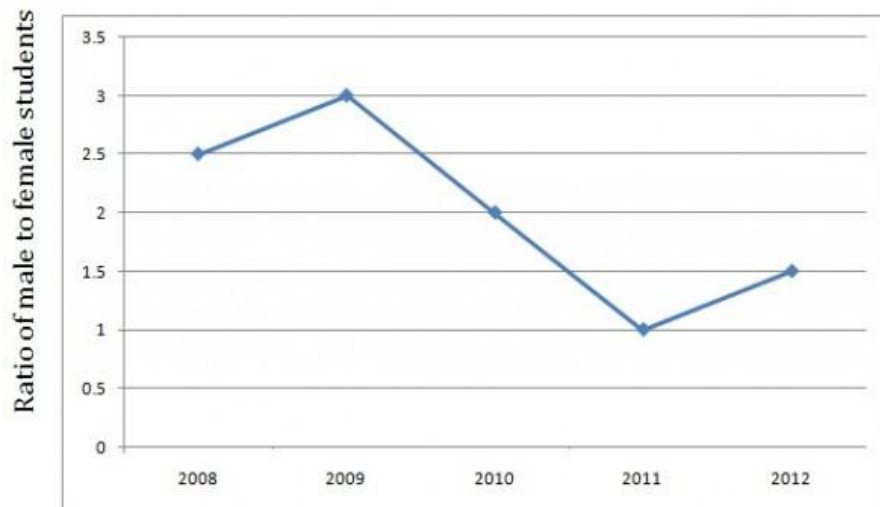
Solution: Option (c)

Explanation:

There are 3 questions in the paper. Each row lists the number of students attempted correctly, wrongly and those did not attempt. We get the strength of the class by adding these columns in any of the rows.  $21+17+6=44$ .

$$\begin{aligned}\text{Avg. marks obtained} &= \frac{(\text{Total marks for Q1}) + (\text{Total marks for Q2}) + (\text{Total marks for Q3})}{\text{Strength of the class}} \\ &= \frac{2 * 21 + 3 * 15 + 2 * 23}{44} = 3.02\end{aligned}$$

**38.** The ratio of male to female students in a college for five years is plotted in the following line graph. If the number of female students in 2011 and 2012 is equal, what is the ratio of male students in 2012 to male students in 2011?



- (a) 1.1  
(c) 1.5:1

- (b) 2:1  
(d) 2.5:1

Solution: Option (c)

Explanation:

Consider the number of female students in 2011 = 100

∴ Number of male students in 2011 = 100

Number of female students in 2012 = 100

Number of male students in 2012 = 150

Ratio = 150/100 = 1.5:1

**39.** Find the sum of the expression

$$\frac{1}{\sqrt{1} + \sqrt{2}} + \frac{1}{\sqrt{2} + \sqrt{3}} + \frac{1}{\sqrt{3} + \sqrt{4}} + \cdots + \frac{1}{\sqrt{80} + \sqrt{81}}$$

- (a) 7  
(c) 9

- (b) 8  
(d) 10

Solution: Option (b)

Explanation:

The given expression can be rationalized in the denominator as follows:

$$= \frac{\sqrt{2} - \sqrt{1}}{(\sqrt{2})^2 - (\sqrt{1})^2} + \frac{\sqrt{3} - \sqrt{2}}{(\sqrt{3})^2 - (\sqrt{2})^2} + \frac{\sqrt{4} - \sqrt{3}}{(\sqrt{4})^2 - (\sqrt{3})^2} + \cdots + \frac{\sqrt{81} - \sqrt{80}}{(\sqrt{81})^2 - (\sqrt{80})^2}$$

$$\begin{aligned} &= \sqrt{81} - \sqrt{1} \\ &= 8 \end{aligned}$$

**40.** Out of all the 2-digit integers between 1 and 100, a 2-digit number has to be selected at random. What is the probability that the selected number is not divisible by 7?

(a) 13/90

(b) 12/90

(c) 78/90

(d) 77/90

Solution: Option (d)

Explanation:

The number of 2 digit multiples of 7 = 13.

$\therefore$  Probability of choosing a number not divisible by 7 =  $\frac{90-13}{90} = \frac{77}{90}$