CDC 07 2022 QA

Scorecard (procreview.jsp?sid=aaaN5tjtX0b7WgArBjowySun Jan 08 23:52:15 IST 2023&qsetId=I3QwywEWSaI=&qsetName=CDC 07 2022 QA)

Accuracy (AccSelectGraph.jsp?sid=aaaN5tjtX0b7WgArBjowySun Jan 08 23:52:15 IST 2023&qsetId=I3QwywEWSaI=&qsetName=CDC 07 2022 QA)

Qs Analysis (QsAnalysis.jsp?sid=aaaN5tjtX0b7WgArBjowySun Jan 08 23:52:15 IST 2023&qsetId=I3QwywEWSaI=&qsetName=CDC 07 2022 QA)

Video Attempt / Solution (VideoAnalysis.jsp?sid=aaaN5tjtX0b7WgArBjowySun Jan 08 23:52:15 IST 2023&qsetId=I3QwywEWSaI=&qsetName=CDC 07 2022 QA)

Solutions (Solution.jsp?sid=aaaN5tjtX0b7WgArBjowySun Jan 08 23:52:15 IST 2023&qsetId=I3QwywEWSaI=&qsetName=CDC 07 2022 QA)

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Section-1

Sec 1

Q.1 [11831809]

Three cars - A, B and C travel at the speed of 90, 60 and 50 km/h respectively. These cars start from the same point and in the same direction. Car A and Car C started at 9 AM and 6 AM respectively. If all the three cars meet at the same place at the same time, then at what time did Car B start?

1 ◯ 6 : 08: 30 AM

2 ◯ 7 : 14 : 15 AM

3 ◯ 8 : 07 : 15 AM

4 ◯ 7 : 07 : 30 AM

Solution:
Correct Answer : 4
Time taken by Car A to meet Car C = 50 × (9 – 6)/(90 – 50) = 3.75 hours
So Car A and Car C meet at 12:45 PM
Distance travelled by Car A = 90 × 3.75 = 337.5 km
Time taken by Car B to travel this distance = 337.5/60 = 5.625 hours
Hence, Car B started at 7:07:30 AM.

Answer key/Solution

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Q.2 [11831809]

If ABCD is a cyclic quadrilateral such that AB = BC = 6 cm, AD = DC and ∠ADC = 120°, then find the area (in sq. cm) of the circle whose diameter is BD.

1 12π

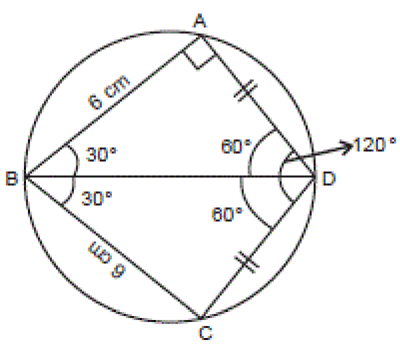
2 24π

3 48π

4 8π

Solution:
Correct Answer : 1

Answer key/Solution



Triangle ABD is congruent to triangle CBD. (SSS property)
∠ADB = ∠CDB = 60° and ∠ABD = ∠CBD
Since ABCD is a cyclic quadrilateral.
Therefore, ∠ABC + ∠ADC = 180°
So, ∠ABD = ∠CBD = 30° and ∠BAC = 90°
So, BD is a diameter of the circle.
So, cos 30° = 6/BD
⇒ BD = $4\sqrt{3}$ cm
Hence, the area of the required circle = $\pi \times (4\sqrt{3}/2)^2 = 12\pi$ sq. cm.

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Q.3 [11831809]

A sum was lent for a year, another sum was lent for 2 years and a third sum was lent for 3 years. Each sum was lent at 12% per annum compound interest. Each sum amounted to the same value. Which of the following can be the first, second and third sums (in Rs.) respectively?

1 ◯ 7,290; 6,750; 6,250

2 ◯ 7,840; 7,000; 6,250

3 ◯ 2,800; 2,700; 2,500

4 ◯ 7,250; 7,500; 7,840

Solution:

Correct Answer : 2

Answer key/Solution

Let the first, second and the third sums be P1, P2, and P3 respectively.
Each sum amounted to the same value.
Let us say each sum amounted to $A = P1 \times 1.12 = P2 \times (1.12)^2 = P3 \times (1.12)^3$
$P1 = A$; $P2 = A \times 25/28$; $P3 = A \times 25^2/28^2$
Therefore, $P1 : P2 : P3 = 28^2 : 25 \times 28 : 25^2 = 784 : 700 : 625$
Hence, we can observe that the amounts given in option (2) satisfy the above ratio.

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Q.4 [11831809]

On Monday, Raj puts ‘x’ number of Re. 1 and Rs. 2 coins, 25% of which are Re. 1 coins, into a box. On each successive day he adds ‘x’ number of coins of the same mix of Re. 1 and Rs. 2 coins without removing any coins that is left. Each day, Asha, Raj’s daughter takes out 25% of the Re. 1 coins and 100% of Rs. 2 coins from the box. On which day, just after Raj has put the coins, will Asha find that more than half the coins in the box are Re. 1 coins?

1 ◯ Friday

2 ◯ Wednesday

3 ◯ Thursday

4 ◯ Saturday

Solution:
Correct Answer : 1

Answer key/Solution

Day 1 – Monday – Asha finds $1/4^{th}$ of Re. 1 coins.
Day 2 – Tuesday – Asha finds 1/4 + 3/4 × 1/4 Re. 1 coins.
Day 3 – Wednesday – Asha finds 1/4 + 3/4 × 1/4 + $(3/4)^2$ × 1/4 of Re. 1 coins.
On nth day, Asha will find 1/4 + 3/4 × 1/4 + ... + $(3/4)^{(n-1)}$ × 1/4

$$=\frac{\frac{1}{4}\left(1-\left(\frac{3}{4}\right)^n\right)}{1-\frac{3}{4}}=1-\left(\frac{3}{4}\right)^n$$

Asha always find 3/4 of Rs. 2 coins, so more than half the coins are Re. 1 coins if $1-\left(\frac{3}{4}\right)^n>\frac{3}{4}$.

Or, $\left(\frac{3}{4}\right)^n<\frac{1}{4}$.

So, $\left(\frac{3}{4}\right)^4=\frac{81}{256}>\frac{1}{4}$ and $\left(\frac{3}{4}\right)^5=\frac{243}{1024}<\frac{1}{4}$.

Hence, this first occur on 5^{th} day, which is Friday.

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Q.5 [11831809]

Let p, q be the integer roots of the quadratic equation $a_1x^2 + b_1x + c_1 = 0$, $a_1 \neq 0$ and r, s be the integer roots of the quadratic equation $a_2x^2 + b_2x + c_2 = 0$, $a_2 \neq 0$ such that p : q = 1 : 2 and r : s = 4 : 5. If p + q = r + s, then the least possible value of |rs – pq| is

1 ◯ 0

2 ◯ 1

3 ◯ 2

4 ◯ 3

Solution:
Correct Answer : 3

Answer key/Solution

Let p, q be k, 2k respectively and r, s be 4m, 5m respectively.
Then, p + q = r + s ⇒ k + 2k = 4m + 5m ⇒ k = 3m
So roots of the first equation will be 3m, 6m.
Therefore, |rs – pq| = |4m × 5m – 3m × 6m| = $|20m^2 - 18m^2| = 2m^2$
At m = 1, the value of |rs – pq| will be minimum which is 2.

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Q.6 [11831809]

P and Q are running around a circular stadium that has three concentric running tracks of lengths 500 m, 600 m and 700 m. They run in opposite directions with initial speeds of 5 m/s and 20 m/s, respectively. Whenever they meet, they move to the next outer track and P doubles his speed whereas Q runs at half the speed in the previous track. After what time (in seconds) from the start will they meet for the third time?

Solution:

Correct Answer : 78

Answer key/Solution

Time for the first meeting = 500/(5 + 20) = 20 seconds
Speeds after the first meeting P = 10 m/sec ; Q = 10 m/sec
Time between the first and the second meeting
= 600/(10 + 10) = 30 seconds
Speeds after the second meeting P = 20 m/s ; Q = 5 m/s
Time between the second and the third meeting = 700/(20 + 5) = 28 seconds
Hence, time from the start to the third meeting = 20 + 30 + 28 = 78 seconds.

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Q.7 [11831809]

How many 5-digit positive integers 'n = abcba' exist such that sum of the digits of n and 'n' are divisible by 5?

1 ○ 12

2 ○ 24

3 ○ 20

4 ○ 19

Solution:

Correct Answer : 3

Answer key/Solution

The number takes a form 5, b, c, b, 5 in which 2b + c = 5k.
Case 1: 2b + c = 0, then b = c = 0
Case 2: 2b + c = 5, then (b, c) = (0, 5), (1, 3) and (2, 1)
Case 3: 2b + c = 10, then (b, c) = (1, 8), (2, 6), ... , (5, 0)
Case 4: 2b + c = 15, then (b, c) = (3, 9) (4, 7), ... , (7, 1)
Case 5: 2b + c = 20, then (b, c) = (6, 8), ... , (9, 2)
Case 6: 2b + c = 25, then (b, c) = (8, 9) and (9, 7)
Hence, total 20 such numbers are possible.

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Q.8 [11831809]

Three vessels contain three different mixtures of milk and water. Volume of each mixture is 15 liters and their respective concentrations of milk are 60%, 80% and 40%. 10 liters of the first, 5 liters of the second and 12.5 liters of the third are mixed and the mixture is named A. The leftovers of the three vessels are mixed and this mixture is named B. Eleven liters of A and 7 liters of B are mixed to form mixture C. Which of the following statements is/are true regarding the milk concentrations of A, B and C?

I. A has the highest concentration.

II. C has the lowest concentration.

III. B has the highest concentration.

IV. C has neither the highest nor the lowest concentration.

1 ◯ I & IV

2 ◯ II & III

3 ◯ III & IV

4 ◯ III only

Solution:

Correct Answer : 3

Answer key/Solution

V1, V2 and V3 have 60%, 80% and 40% concentration of milk and water respectively.
Volume of A = 27.5 liters
Milk in A = 10/15 × 9 + 5/15 × 12 + 12.5/15 × 6 = 15 liters
Water in A = 27.5 – 15 = 12.5 liters
Ratio of milk and water in A = 15 : 12.5 = 6 : 5.
Volume of B = 17.5 liters
Milk in B = 5/15 × 9 + 10/15 × 12 + 2.5/15 × 6 = 12 liters
Water in B = 17.5 – 12 = 5.5 liters
Ratio of milk and water in B = 12 : 5.5 = 24 : 11
Volume of C = 18 liters
Milk in C = 15 × 11/27.5 + 12 × 7/17.5 = 10.8 liters
Water in C = 18 – 10.5 = 7.2 liters
Ratio of milk and water in C = 10.8 : 7.2 = 3 : 2
We can see that in A the quantity of milk is 1.2 times that of water, in B the quantity of milk is 2.18 times that of water and in C the quantity of milk is 1.5 times that of water.
So B has the highest concentration of milk and C does not have the lowest concentration.
Hence, option (3) is correct.

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Q.9 [11831809]

Let $xyz = 10^{81}$ and $\log_{10} x \times \log_{10} y + \log_{10} y \times \log_{10} z + \log_{10} z \times \log_{10} x = 468$, where x, y and z are positive numbers, then $(\log_{10} x)^2 + (\log_{10} y)^2 + (\log_{10} z)^2$ is divisible by

1 ◯ 5^4

2 ◯ 3^3

3 ◯ $5^3 \times 3^3$

4 ◯ $2^2 \times 3^4$

Solution:

Correct Answer : 1

Answer key/Solution

$xyz = 10^{81}$

$\Rightarrow \log_{10} xyz = 81$

$\Rightarrow \log_{10} x + \log_{10} y + \log_{10} z = 81$ ... (i)

$\Rightarrow \log_{10} x \times \log_{10} y + \log_{10} y \times \log_{10} z + \log_{10} z \times \log_{10} x = 468$ ... (ii)

Apply the algebraic equation,

$(a + b + c)^2 = a^2 + b^2 + c^2 + 2(ab + ac + bc)$

Therefore, from (i) and (ii),

$(\log_{10} x)^2 + (\log_{10} y)^2 + (\log_{10} z)^2$

$= 81^2 - 2 \times 468 = 5625 = 5^4 \times 3^2$

Hence, the correct answer is option (1).

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Q.10 [11831809]

A fort has a circular boundary and has 4 gates on its east, west, north and south. A watchman standing 3 km east of the eastern gate can just see a lion standing 9 km north of the western gate. What is the shortest distance (in km) between the watchman and the West Gate?

1 ◯ 9

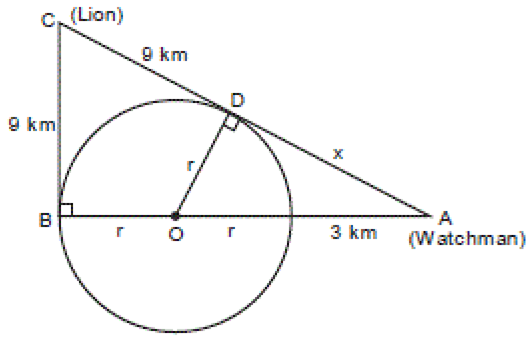
2 ◯ 11

3 ◯ 12

4 ◯ 13

Solution:
Correct Answer : 3

Answer key/Solution



In right angled triangle ADO,

$$x = \sqrt{(3+r)^2 - r^2} \Rightarrow x = \sqrt{9+6r}$$

Triangle ABC and triangle ADO are similar.

Therefore, $\frac{3+2r}{9} = \frac{x}{r}$

$$\Rightarrow \frac{3+2r}{9} = \frac{\sqrt{9+6r}}{r}$$

$$\Rightarrow \frac{(3+2r)^2}{9^2} = \frac{3(3+2r)}{r^2}$$

$$\Rightarrow r^2 \times (3+2r) = \left(\frac{9}{2}\right)^2 \times 12$$

So, r = 9/2 km
Hence, the shortest distance between the watchman and the west gate
= 3 + 9/2 + 9/2 = 12 km.

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Q.11 [11831809]

A pool has a capacity of 8.712 lakh liters. Two pipes of diameters 6 cm and 4 cm are used to fill the pool. The rate at which water flows through the first and the second pipe is 14 liters per second and 8 liters per second respectively. An emptying pipe of diameter 2 cm is also connected to the pool and water flows through this at a rate of 4 liters per second. If all the three pipes are opened simultaneously, then find the time taken to fill the empty pool (in minutes).

Solution:
Correct Answer : 806.67

Answer key/Solution

Time taken to fill the empty pool = 871200/(14 + 8 – 4)
= 871200/18 = 48400 seconds = 806.67 minutes.

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Q.12 [11831809]

The average marks scored by 24 students in a Quantitative Aptitude Test are 25. The maximum number of marks scored by a student is 29 and the minimum is 21. The marks scored by students are between 21 and 29. What can be the maximum number of students who scored at least 27 marks?

1 ○ 14

2 ○ 15

3 ○ 16

4 ○ 8

Solution:

Correct Answer : 2

Answer key/Solution

To maximize the number of students who scored 27 marks or more, one should assume that only one student has scored 29. To counter him, there will be one student who will score 21 marks.
So, remaining students = 24 – 2 = 22
Now, to maximize the 27 and above marks for every two students who are scoring 27, there will be one student scoring 21. This is done, to arrive at the average of 25. We will have 14 students with a score of 27 and 7 students with a score of 21. The last student will have a score of 25.
Hence, the maximum number of students with 27 or more marks = 14 + 1 = 15.

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Q.13 [11831809]

Let f and g be a real valued functions defined as $f(x) = x^2 + 8$ and $g(x) = f(x - 2) + f(x + 2) - 36$. For how many integral values of 'x', $g(x) < 0$?

Solution:

Correct Answer : 5

Answer key/Solution

$g(x) = f(x - 2) + f(x + 2) - 36$
Or, $g(x) = 2x^2 + 24 - 36 = 2x^2 - 12 < 0$
Or, $x^2 - 6 < 0$
Or, $x^2 < 6$
Hence, x = –2, –1, 0, 1 and 2 are the integer values.

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Q.14 [11831809]

The inhabitants of Kailasa island (where the currency is kD) are taxed in a funny manner. They must pay a fixed sum irrespective of their income level. In addition to this they have to pay a sum which is proportional to the excess of their annual salary over kD.40,000. Nityananda pays a total tax of kD.8,200 per annum when his annual salary is kD.60,000 and his brother pays a total tax of kD.9,600 per annum when his annual salary is kD.80,000. What is the annual salary (in kD) of Yogananda who pays a total tax of kD.13,100 per annum?

1 ◯ 1,20,000

2 ◯ 1,12,000

3 ◯ 1,30,000

4 ◯ 1,07,000

Solution:

Correct Answer : 3

Answer key/Solution

We can say that the tax calculation at Kailasa Island is as follows:
Tax = F + K (Salary – 40,000)
Tax paid by Nityananda: 8,200 = F + K (60,000 – 40,000)
8200 = F + 20,000K ...(i)
Tax paid by Nityananda's brother: 9,600 = F + K (80,000 – 40,000)
9600 = F + 40,000K ...(ii)
From (i) and (ii),
F = 6,800 and K = 7/100
Now, tax paid by Yogananda = kD.13,100
Therefore, 13,100 = 6800 + 7/100 (Salary – 40,000)
Hence, annual Salary of Yogananda = kD.1,30,000.

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Q.15 [11831809]

Three types of chocolates numbered 60, 84 and 126 are to be distributed among the students. If each student gets equal number of chocolates but of one type only, find the minimum number of students.

Solution:

Correct Answer : 45

Answer key/Solution

HCF(60, 84, 126) = 6
Hence, the minimum number of students
= 60/6 + 84/6 + 126/6 = 10 + 14 + 21 = 45.

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Q.16 [11831809]

In the triangle PQR, A, B and C are the midpoints of QR, PR and PQ. PA and RC meet at point D. A quadrilateral is formed by joining the points CQAD. What is the ratio of the area of quadrilateral CQAD and the area of triangle PCR?

1 ○ 3 : 4

2 ○ 1 : 3

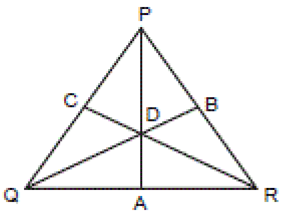
3 ○ 1 : 2

4 ○ 2 : 3

Solution:

Correct Answer : 4

Answer key/Solution



By construction we know that D is the centroid, which is the point where the three medians meet.
The three medians divide the triangle into six triangles of equal areas.
Quadrilateral CQAD consists of two such triangles.
Triangle PCR consists of 3 such triangles.
Hence, the required ratio is 2 : 3.

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Q.17 [11831809]

Let $|x + y| + |x - y| = 4$, then what is the maximum possible value of $x^2 - 8x + y^2 - 3y$?

Solution:

Correct Answer : 30

Answer key/Solution

Since the equation $|x + y| + |x - y| = 4$ is dealing with absolute values, the following could be deduced:

$(x + y) + (x - y) = 4$

$(x + y) - (x - y) = 4$

$-(x + y) + (x - y) = 4$

$-(x + y) - (x - y) = 4$

Solving the above equations, we get $x = 2$, $y = 2$, $x = -2$, and $y = -2$.

In $x^2 - 8x + y^2 - 3y$, we care most about $-8x$ and $-3y$, since both x^2 and y^2 are non-negative.

To maximize $-8x$ and $-3y$, x would have to be -2 and y have to be -2.

Therefore, when $x = -2$ and $y = -2$, the equation evaluates to 30.

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Q.18 [11831809]

Three persons A, B and C working alone can complete a piece of work in 16 days, 24 days and 20 days respectively. Every day B works half a day with A, who works full day, while C works 2/3rd day. After 8 days A and C stop working, then how much time (in days) will take by B to complete the remaining work while working for 2/5th day?

Solution:

Correct Answer : 4

Answer key/Solution

Let the total work = LCM(16, 24, 20) = 240 units
Work can be completed by A, B and C in one day = 15, 10 and 12 units
Total work completed in first 8 days = 15 × 8 + 10 × 8 × 1/2 + 12 × 8 × 2/3 = 224 units
Remaining work = 240 – 224 = 16 units
Hence, the remaining work completed by B in 16/(10 × 2/5) = 4 days.

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Q.19 [11831809]

A fruit vendor bought some apples and some oranges. He bought some apples at the rate of Rs.192 per dozen and 3 times as many oranges at the rate of Rs.96 per dozen. One-sixth of the apples and one-fifth of the oranges got spoilt. He sold the remaining apples at Rs.216 per dozen and the remaining oranges at Rs.180 per dozen. Find his profit or loss percentage.

1 ◯ 24.5%

2 ◯ 16.5%

3 ◯ 27.5%

4 ◯ 18.25%

Solution:

Correct Answer : 3

Answer key/Solution

Let the number of apples and oranges purchased be n and 3n respectively.
CP of n apples = 16n ; CP of 3n oranges = 24n, Total CP = 40n
One-sixth of the apples and one-fifth of the oranges got spoilt.
SP of remaining apples = 18 × 5n/6 = 15n
SP of remaining oranges = 15 × 12n/5 = 36n
Total SP = 51n
Hence, the profit percentage = (51 – 40)n/40n × 100 = 27.5%.

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Q.20 [11831809]

Let p, q and r be non-negative integers such that p + q + r = 9. Then the maximum value of (pqr + pq + qr + rp)/6 is

Solution:

Correct Answer : 9

Answer key/Solution

$(p + 1)(q + 1)(r + 1) = pqr + pq + qr + rp + p + q + r + 1$

$= pqr + pq + qr + rp + 10$

Since AM $\geq$ GM

Therefore, $\frac{(p+1)(q+1)(r+1)}{3} \geq \sqrt[3]{(p+1)(q+1)(r+1)}$

So $(p + 1)(q + 1)(r + 1)$ is maximum at 64, which occurs when $p = q = r = 3$.

Hence, the maximum value of $(pqr + pq + qr + rp)/6 = (64 - 10)/6 = 9$.

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Q.21 [11831809]

In 2021, the price of article A rose by 25% during 1st quarter, fell by 20% during 2nd quarter, rose by 20% during 3rd quarter, and fell by x% during 4th quarter. The price of article A at the end of 4th quarter was the same as it had been at the beginning of 1st quarter. To the nearest integer, what is ‘x’?

1 ○ 12

2 ○ 17

3 ○ 20

4 ○ 25

Solution:

Correct Answer : 2

Answer key/Solution

Let A be the price at the beginning of 1^{st} quarter.

The price at the end of 3^{rd} quarter was $1.25 \times 0.8 \times 1.2A = 1.2A$

Because the price at the end of 4^{th} quarter was A, the price decreased by 0.2A during 4^{th} quarter, and the percent decrease was $x = 100 \times \frac{0.2A}{1.2A} = \frac{100}{6} \approx 16.7$.

Hence, to the nearest integer ‘x’ is 17.

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Q.22 [11831809]

Let $\frac{1+ab}{a+b} < \frac{3}{2}$ where a and b are integers and a, b > 1, then how many pairs of (a, b) are possible?

Solution:

Correct Answer : 3

Answer key/Solution

$\frac{1+ab}{a+b} < \frac{3}{2}$

Or, 2 + 2ab < 3a + 3b

Or, 4ab – 6a – 6b + 4 + 9 – 9 < 0

Or, (2a – 3)(2b – 3) < 5

So here 2a – 3 and 2b – 3 both cannot be even else a and b will not be integers.

So (2a – 3, 2b – 3) = (1, 1), (1, 3) and (3,1)

⇒ (a, b) = (2, 2), (2, 3), (3, 2)

Hence, the possible pairs (a, b) are 3.

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