Tips, Formulae and Shortcuts for Linear Equations

By

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Cracku Tip 1 – Linear equations

- Linear equations is one of the foundation topics in the Quant section of CAT.

- Hence, fundamentals of this concept are useful in solving the questions of the other topics by assuming the unknown values as variables.

- Be careful of silly mistakes in this topic as that is how students generally lose marks here.

- Generally, the number of equations needed to solve the given problem is equal to the number of variables

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Cracku Tip 2 – Linear equations

- A linear equation is an equation which gives straight line when plotted on a graph.

- Linear equations can be of one variable or two variable or three variable.

- Let a, b, c and d are constants and x, y and z are variables. A general form of single variable linear equation is $ax+b = 0$.

- A general form of two variable linear equation is $ax+by = c$.

- A general form of three variable linear equation is $ax+by+cz = d$.

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Cracku Tip 3 – Linear equations

Equations with two variables:

- Consider two equations ax+by = c and mx+ny = p. Each of these equations represent two lines on the x-y co-ordinate plane. The solution of these equations is the point of intersection.

- If $\dfrac{a}{m} = \dfrac{b}{n} \neq \dfrac{c}{p}$ then the slope of the two equations is equal and so they are parallel to each other. Hence, no point of intersection occurs. Therefore no solution.

- If $\dfrac{a}{m} \neq \dfrac{b}{n}$ then the slope is different and so they intersect each other at a single point. Hence, it has a single solution.

- If $\dfrac{a}{m} = \dfrac{b}{n} = \dfrac{c}{p}$ then the two lines are same and they have infinite points common to each other. So, infinite solutions occurs

Cracku Tip 4 – Linear equations

General Procedure to solve linear equations:

- Aggregate the constant terms and variable terms

- For equations with more than one variable, eliminate variables by substituting equations in their place.

- Hence, for two equations with two variables x and y, express y in terms of x and substitute this in the other equation.

- For Example, let x+y = 14 and x+4y = 26 then x = 14-y (from equation 1) substituting this in equation 2, we get 14-y+4y = 26. Hence, y = 4 and x = 10.

Cracku Tip 5 – Linear equations

General Procedure to solve linear equations:

For equations of the form ax+by = c and mx+ny = p, find the LCM of b and n. Multiply each equation with a constant to make the y term coefficient equal to the LCM. Then subtract equation 2 from equation 1.

Example:

Let 2x+3y = 13 and 3x+4y = 18 are the given equations (1) and (2).

- LCM of 3 and 4 is 12.

- Multiplying (1) by 4 and (2) by 3, we get 8x+12y = 52 and 9x+12y = 54.

- (2)-(1) gives x=2, y=3

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Cracku Tip 6 – Linear equations

- If the system of equations has *n* variables with *n-1* equations then the solution is indeterminate

- If system of equations has *n* variables with *n-1* equations with some additional conditions like the variables are integers then the solution may be determinate

- If system of equations has *n* variables with *n-1* equations then some combination of variables may be determinable.

- For example, if ax+by+cz = d and mx+ny+pz = q, if a, b, c are in Arithmetic progression and m, n and p are in AP then the sum x+y+z is determinable.

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Cracku Tip 7 – Linear equations

Equations with three variables:

Let the equations be $a_1x+b_1y+c_1z = d_1$, $a_2x+b_2y+c_2z = d_2$ and $a_3x+b_3y+c_3z = d_3$. Here we define the following matrices.

$$D = \begin{bmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{bmatrix} \quad D_x = \begin{bmatrix} d_1 & b_1 & c_1 \\ d_2 & b_2 & c_2 \\ d_3 & b_3 & c_3 \end{bmatrix} \quad D_y = \begin{bmatrix} a_1 & d_1 & c_1 \\ a_2 & d_2 & c_2 \\ a_3 & d_3 & c_3 \end{bmatrix} \quad D_z = \begin{bmatrix} a_1 & b_1 & d_1 \\ a_2 & b_2 & d_2 \\ a_3 & b_3 & d_3 \end{bmatrix}$$

- If Determinant of D ≠ 0, then the equations have a unique solution.

- If Determinant of D = 0, and at least one but not all of the determinants D_x, D_y or D_z is zero, then no solution exists.

- If Determinant of D = 0, and all the three of the determinants D_x, D_y and D_z are zero, then there are infinitely many solution exists.

- Determinant can be calculated by $D = a_1(b_2c_3-c_2b_3)-b_1(a_2c_3-c_2a_3)+c_1(a_2b_3-b_2a_3)$

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Instructions

For the following questions answer them individually

Question 1

Suppose you have a currency, named Miso, in three denominations: 1 Miso, 10 Misos and 50 Misos. In how many ways can you pay a bill of 107 Misos?

A   17

B   16

C   18

D   15

E   19

Answer: C

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Explanation:

If two 50 Misos are used, the 107 can be paid in only 1 way.

If one 50 Miso is used, the number of ways of paying 107 is 6 - zero 10 Miso, one 10 Miso and so on till five 10 Misos.

If no 50 Miso is used, the number of ways of paying 107 is 11 - zero 10 Miso, one 10 Miso and so on till ten 10 Misos.

So, the total number of ways is 18

Question 2

The price of Darjeeling tea (in rupees per kilogram) is 100 + 0.10n, on the nth day of 2007 (n=1, 2, ..., 100), and then remains constant. On the other hand, the price of Ooty tea (in rupees per kilogram) is 89 + 0.15n, on the nth day of 2007 (n = 1, 2, ..., 365). On which date in 2007 will the prices of these two varieties of tea be equal?

A   May 21

B   April 11

C   May 20

D   April 10

E   June 30

Answer: C

▶ Video Solution

Explanation:

Price of Darjeeling tea on 100th day= 100+(0.1*100)=110
Price of Ooty tea on nth day= 89+0.15n
Let us assume that the price of both varieties of tea would become equal on nth day where n<=100
So
89+0.15n=100+0.1n
n=220 which does not satisfy the condition of n<=100
So the price of two varieties would become equal after 100th day.
89+0.15n=110
n=140
140th day of 2007 is May 20 (Jan=31,Feb=28,March=31,April=30,May=20)

Question 3

When you reverse the digits of the number 13, the number increases by 18. How many other two-digit numbers increase by 18 when their digits are reversed?

A 5

B 6

C 7

D 8

E 10

   Answer: B

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Explanation:
Let the number be xy
10y + x = 10x + y + 18
=> 9y - 9x = 18
=> y - x = 2
So, y can take values from 9 to 4 (since 3 is already counted in 13)
Number of possible values = 6

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Question 4

Three friends, returning from a movie, stopped to eat at a restaurant. After dinner, they paid their bill and noticed a bowl of mints at the front counter. Sita took one-third of the mints, but returned four because she had a momentary pang of guilt. Fatima then took one-fourth of what was left but returned three for similar reason. Eswari then took half of the remainder but threw two back into the bowl. The bowl had only 17 mints left when the raid was over. How many mints were originally in the bowl?

A 38

B 31

C 41

D None of these

   Answer: D

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Explanation:
Let the total number of mints in the bowl be n
Sita took n/3 - 4. Remaining = 2n/3 + 4
Fatim took 1/4(2n/3 + 4) - 3. Remaining = 3/4(2n/3 + 4) + 3
Eswari took 1/2(3/4(2n/3+4)+3) - 2
Remaining = 1/2(3/4(2n/3+4)+3) + 2 = 17
=> 3/4(2n/3+4)+3 = 30 => (2n/3+4) = 36 => n = 48
So, the answer is option d)

Question 5

At a certain fast food restaurant, Brian can buy 3 burgers, 7 shakes, and one order of fries for Rs. 120 exactly. At the same place it would cost Rs. 164.5 for 4 burgers, 10 shakes, and one order of fries. How much would it cost for an ordinary meal of one burger, one shake, and one order of fries?

A Rs. 31

B Rs. 41

C Rs. 21

D Cannot be determined

Answer: A

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Explanation:
Let the price of 1 burger be x and the price of 1 shake be y and the prize of 1 french fries be z
3x + 7y + z = 120
4x + 10y + z = 164.5
=> x + 3y = 44.5
=> x = 44.5 - 3y
=> 3(44.5 - 3y) + 7y + z = 120 => z = 120 - 133.5 + 2y
So, x+y+z = 44.5 - 3y + y -13.5 + 2y = 31
So, the cost of a meal consisting of 1 burger, 1 shake and 1 french fries = Rs 31

Question 6

The number of solutions (x, y, z) to the equation $x - y - z = 25$, where x, y, and z are positive integers such that $x \leq 40, y \leq 12$, and $z \leq 12$ is

A 101

B 99

C 87

D 105

Answer: B

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Explanation:
x - y - z = 25 and $x \leq 40, y \leq 12, z \leq 12$
If x = 40 then y + z = 15. Now since both y and z are natural numbers less than 12, so y can range from 3 to 12 giving us a total of 10 solutions.Similarly, if x = 39, then y + z = 14. Now y can range from 2 to 12 giving us a total of 11 solutions.
If x = 38, then y + z = 13. Now y can range from 1 to 12 giving us a total of 12 solutions.
If x = 37 then y + z = 12 which will give 11 solutions.
Similarly on proceeding in the same manner the number of solutions will be 10, 9, 8, 7 and so on till 1.
Hence, required number of solutions will be (1 + 2 + 3 + 4 . . . . + 12) + 10 + 11
= 12*13/2 + 21
78 + 21 = 99

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Question 7

How many different pairs(a,b) of positive integers are there such that $a \geq b$ and $\frac{1}{a} + \frac{1}{b} = \frac{1}{9}$?

Answer:3

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Explanation:

$\frac{1}{a} + \frac{1}{b} = \frac{1}{9}$

=> $ab = 9(a + b)$

=> $ab - 9(a + b) = 0$

=> $ab - 9(a + b) + 81 = 81$

=> $(a - 9)(b - 9) = 81, a > b$

Hence we have the following cases,

$a - 9 = 81, b - 9 = 1$ => $(a, b) = (90, 10)$

$a - 9 = 27, b - 9 = 3$ => $(a, b) = (36, 12)$

$a - 9 = 9, b - 9 = 9$ => $(a, b) = (18, 18)$

Hence there are three possible positive integral values of (a,b)

Question 8

If $5^x - 3^y = 13438$ and $5^{x-1} + 3^{y+1} = 9686$, then x + y equals

Answer: 13

▶ Video Solution

Explanation:

$5^x - 3^y = 13438$ and $5^{x-1} + 3^{y+1} = 9686$

$5^x + 3^y * 15 = 9686 * 5$

$5^x + 3^y * 15 = 48430$

$16*3^y=34992$

$3^y = 2187$

y = 7

$5^x=13438+2187=15625$

x=6

x+y = 13

Question 9

In 2010, a library contained a total of 11500 books in two categories - fiction and nonfiction. In 2015, the library contained a total of 12760 books in these two categories. During this period, there was 10% increase in the fiction category while there was 12% increase in the non-fiction category. How many fiction books were in the library in 2015?

A   6160

B   6600

C   6000

D   5500

Answer: B

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Explanation:

Let the number of fiction and non-fiction books in 2010 = 100a, 100b respectively

It is given that the total number of books in 2010 = 11500

100a+100b = 11500   -------Eq 1

The number of fiction and non-fiction books in 2015 = 110a, 112b respectively

110a+112b = 12760   -------Eq 2

On solving both the equations we get, b=55, a= 60

The number of fiction books in 2015 = 110*60=6600

Question 10

Let a, b, x, y be real numbers such that $a^2 + b^2 = 25, x^2 + y^2 = 169$, **and** $ax + by = 65$. **If** $k = ay - bx$, **then**

A $0 < k \le \frac{5}{13}$

B $k > \frac{5}{13}$

C $k = \frac{5}{13}$

D   k = 0

Answer: D

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Explanation:
$(ax + by)^2 = 65^2$

$a^2x^2 + b^2y^2 + 2abxy = 65^2$
$k = ay - bx$

$k^2 = a^2y^2 + b^2x^2 - 2abxy$

$(a^2 + b^2)(x^2 + y^2) = 25 * 169$

$a^2x^2 + a^2y^2 + b^2x^2 + b^2y^2 = 25 \times 169$

$k^2 = 65^2 - (25 \times 169)$

k = 0

D is the correct answer.

Question 11

A gentleman decided to treat a few children in the following manner. He gives half of his total stock of toffees and one extra to the first child, and then the half of the remaining stock along with one extra to the second and continues giving away in this fashion. His total stock exhausts after he takes care of 5 children. How many toffees were there in his stock initially?

Answer:62

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Explanation:
Let the initial number of chocolates be 64x.

First child gets 32x+1 and 32x-1 are left.

2nd child gets 16x+1/2 and 16x-3/2 are left

3rd child gets 8x+1/4 and 8x-7/4 are left

4th child gets 4x+1/8 and 4x-15/8 are left

5th child gets 2x+1/16 and 2x-31/16 are left.

Given, 2x-31/16=0=> 2x=31/16 => x=31/32.

∴. Initially the Gentleman has 64x i.e. 64*31/32 =62 chocolates.

Question 12

Let A, B and C be three positive integers such that the sum of A and the mean of B and C is 5. In addition, the sum of B and the mean of A and C is 7. Then the sum of A and B is

A 5

B 4

C 6

D 7

Answer: C

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Explanation:

Given

A+(B+C)/2=5 => 2A+B+C=10....(i)

(A+C)/2 +B=7 => A+2B+C=14.....(ii)

(i)-(ii)=> B-A=4 => B=4+A.

Given, A, B, C are positive integers

If A=1=>B=5 => C=3

If A=2=>B=6 => C=0 but this is invalid as C is positive.

Similarly if A>2 C will be negative and cases are not valid.

Hence, A+B=6.

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Question 13

Dick is thrice as old as Tom and Harry is twice as old as Dick. If Dick's age is 1 year less than the average age of all three, then Harry's age, in years, is

Answer: 18

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Explanation:

Let tom's age = x

=> Dick=3x

=>harry = 6x

Given,

3x+1 = (x+3x+6x)/3

=> x= 3

Hence, Harry's age = 18 years

Question 14

Let k be a constant. The equations $kx + y = 3$ and $4x + ky = 4$ have a unique solution if and only if

A $\mid k \mid \neq 2$

B $\mid k \mid = 2$

C $k \neq 2$

D $k = 2$

Answer: A

Explanation:

Two linear equations ax+by= c and dx+ ey = f have a unique solution if $\frac{a}{d} \neq \frac{b}{e}$

Therefore, $\frac{k}{4} \neq \frac{1}{k}$ => $k^2 \neq 4$

=> k $\neq$ |2|

Question 15

In May, John bought the same amount of rice and the same amount of wheat as he had bought in April, but spent ₹ 150 more due to price increase of rice and wheat by 20% and 12%, respectively. If John had spent ₹ 450 on rice in April, then how much did he spend on wheat in May?

A   Rs.560

B   Rs.570

C   Rs.590

D   Rs.580

Answer: A

Explanation:

Let John buy "m" kg of rice and "p" kg of wheat.

Now let the price of rice be "r" in April. Price in May will be "1.2(r)"

Now let the price of wheat be "w" in April . Price in April will be "1.12(w)".

Now he spent ₹150 more in May , so 0.2(rm)+0.12(wp)=150

Its also given that he had spent ₹450 on rice in April. So (rm)=450

So 0.2(rm)= (0.2)(450)=90 Substituting we get (wp)=60/0.12 or (wp)=500

Amount spent on wheat in May will be 1.12(500)=₹560

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Question 16

If x and y are non-negative integers such that $x + 9 = z$, $y + 1 = z$ and $x + y < z + 5$, then the maximum possible value of $2x + y$ equals

Answer:23

Explanation:

We can write x=z-9 and y=z-1 Now we have x+y< z+5

Substituting we get z-9+z-1<z+5 or z<15

Hence the maximum possible value of z is 14

Maximum value of "x" is 5 and maximum value of "y" is 13

Now 2x+y = 10+13=23

Question 17

Aron bought some pencils and sharpeners. Spending the same amount of money as Aron, Aditya bought twice as many pencils and 10 less sharpeners. If the cost of one sharpener is ₹ 2 more than the cost of a pencil, then the minimum possible number of pencils bought by Aron and Aditya together is

A   33

B   27

C   30

D   36

Answer: A

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Explanation:

Let the number of pencils bought by Aron be "p" and the cost of each pencil be "a".

Let the number of sharpeners bought Aron be "s" and the cost of each sharpener be "b".

Now amount spent by Aron will be (pa)+(sb)

Aditya bought (2p) pencils and (s-10) sharpeners. Amount spent will be (2pa)+(s-10)b

Amount spent in both the cases is same

pa + sb = 2pa + (s-10)b or pa=10b

Now its given in the question that cost of sharpener is 2 more than pencil i.e. b=a+2

pa= 10a+20 or a=20/(p-10)

Now the number of pencils has to be minimum, for that we have to find smallest "p" such that both "p" and "a" are integers. The smallest such value is p=11 . Total number of pencils bought will be p+2p=11+22=33

Question 18

A basket of 2 apples, 4 oranges and 6 mangoes costs the same as a basket of 1 apple, 4 oranges and 8 mangoes, or a basket of 8 oranges and 7 mangoes. Then the number of mangoes in a basket of mangoes that has the same cost as the other baskets is

A   11

B   13

C   10

D   12

Answer: B

▶ Video Solution

Explanation:

Let the cost of an apple, an orange and a mango be a, o, and m respectively.

Then it is given that:

2a+4o+6m = a+4o+8m

or a = 2m.

Also, a+4o+8m = 8o + 7m

10m-7m = 4o

3m = 4o.

We can now express the cost of a basket in terms of mangoes only:

2a+4o+6m = 4m+3m+6m = 13m.

Question 19

If $3x + 2 \mid y \mid + y = 7$ and $x + \mid x \mid + 3y = 1$ then $x + 2y$ is:

A $-\frac{4}{3}$

B $\frac{8}{3}$

C 0

D 1

 Answer: C

▶ Video Solution

Explanation:
We need to check for all regions:

x >= 0, y >= 0

x >= 0, y < 0

x < 0, y >= 0

x < 0, y < 0

However, once we find out the answer for any one of the regions, we do not need to calculate for other regions since the options suggest that there will be a single answer.

Let us start with **x >= 0, y >= 0,**

3x + 3y = 7

2x + 3y = 1

Hence, x = 6 and y = -11/3

Since y > = 0, this is not satisfying the set of rules.

Next, let us test **x >= 0, y < 0,**

3x - y = 7

2x + 3y = 1

Hence, y = -1

x = 2.

This satisfies both the conditions. Hence, this is the correct point.

WE need the value of x + 2y

x + 2y = 2 + 2(-1) = 2 - 2 = 0.

Question 20

A confused bank teller transposed the rupees and paise when he cashed a cheque for Shailaja, giving her rupees instead of paise and paise instead of rupees. After buying a toffee for 50 paise, Shailaja noticed that she was left with exactly three times as much as the amount on the cheque. Which of the following is a valid statement about the cheque amount?

A   Over Rupees 13 but less than Rupees 14

B   Over Rupees 7 but less than Rupees 8

C   Over Rupees 22 but less than Rupees 23

D   Over Rupees 18 but less than Rupees 19

E   Over Rupees 4 but less than Rupees 5

Answer: D

▶ Video Solution

Explanation:

Let the value of cheque be x Rs and y ps and the amount she received is y Rs and x ps.

After 50 ps is deducted she has the amount which is 3 times the amount on cheque,

So 100y+x-50=3(100x+y)   (After converting the amount in paise)

y= (299x+50)/97 = 3x+ (8x+50)/97

Now both x and y are integers, so from options we put x=18, (8x+50)/97 = 194/97 =2 which is an integer. Hence, D is the answer.

Instructions

DIRECTIONS for the following two questions: Answer the questions on the basis of the information given below.

A certain perfume is available at a duty-free shop at the Bangkok international airport. It is priced in the Thai currency Baht but other currencies are also acceptable. In particular, the shop accepts Euro and US Dollar at the following rates of exchange:

US Dollar 1 = 41 Bahts

Euro 1= 46 Bahts

The perfume is priced at 520 Bahts per bottle. After one bottle is purchased, subsequent bottles are available at a discount of 30%. Three friends S, R and M together purchase three bottles of the perfume, agreeing to share the cost equally. R pays 2 Euros. M pays 4 Euros and 27 Thai Bahts and S pays the remaining amount in US Dollars.

Question 21

How much does R owe to S in Thai Baht?

A   428

B   416

C   334

D   324

Answer: D

▶ Video Solution

Explanation:

Total to be paid = 1248 Baht

Each has to pay 1248/3 = 416 Baht

R paid 92 Baht

M paid 184+27 = 211 Baht

So, R owes S 416 - 92 = 324 Baht

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Question 22

How much does M owe to S in US Dollars?

A 3

B 4

C 5

D 6

Answer: C

▶ Video Solution

Explanation:
Total to be paid = 1248 Baht

Each has to pay 1248/3 = 416 Baht

R paid 92 Baht

M paid 184+27 = 211 Baht

So, R owes S 416 - 92 = 324 Baht

M owes S 416-211 Baht = 205 Baht = 5 US Dollars

Instructions
For the following questions answer them individually

Question 23

Which one of the following conditions must p, q and r satisfy so that the following system of linear simultaneous equations has at least one solution, such that $p + q + r \neq 0$?

x+ 2y - 3z = p

2x + 6y - 11z = q

x - 2y + 7z = r

A 5p -2q - r = 0

B 5p + 2q + r = 0

C 5p + 2q - r = 0

D 5p - 2q + r = 0

Answer: A

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Explanation:
Substitute value of p,q,r in the options only option A satisfies .

5(x+2y-3z)-2(2x+6y-11z)-(x-2y+7z) = 5x+10y-15z-4x-12y+22z-x+2y-7z = 0

Question 24

A leather factory produces two kinds of bags, standard and deluxe. The profit margin is Rs. 20 on a standard bag and Rs. 30 on a deluxe bag. Every bag must be processed on machine A and on Machine B. The processing times per bag on the two machines are as follows:

	Time Required (Hours/bag)	
	Machine A	Machine B
Standard Bag	4	6
Deluxe Bag	5	10

The total time available on machine A is 700 hours and on machine B is 1250 hours. Among the following production plans, which one meets the machine availability constraints and maximizes the profit?

A   Standard 75 bags, Deluxe 80 bags

B   Standard 100 bags, Deluxe 60 bags

C   Standard 50 bags, Deluxe 100 bags

D   Standard 60 bags, Deluxe 90 bags

Answer: A

▶ Video Solution

Explanation:
.Let x be no. of standard bags and y be no. of deluxe bags. According to given conditions we have 2 equations 4x+5y<=700 and 6x+10y<=1250. Here option A satisfies both the equations.

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Question 25

A test has 50 questions. A student scores 1 mark for a correct answer, -1/3 for a wrong answer, and -1/6 for not attempting a question. If the net score of a student is 32, the number of questions answered wrongly by that student cannot be less than

A   6

B   12

C   3

D   9

Answer: C

▶ Video Solution

Explanation:
Let the number of questions answered correctly be x and the number of questions answered wrongly be y.

So, number of questions left unattempted = (50-x-y)

So, x - y/3 - (50-x-y)/6 = 32

=> 6x - 2y - 50 + x + y = 192 => 7x - y = 242 => y = 7x - 242

If x = 35, y = 3

If x = 36, y = 10

So, min. value of y is 3.

The number of wrongly answered questions cannot be less than 3.

Instructions

Directions for the following two questions: Answer the questions on the basis of the information given below.

In an examination, there are 100 questions divided into three groups A, B and C such that each group contains at least one question. Each question in group A carries 1 mark, each question in group B carries 2 marks and each question in group C carries 3 marks. It is known that the questions in group A together carry at least 60% of the total marks.

Question 26

If group B contains 23 questions, then how many questions are there in group C?

A   1

B   2

C 3

D   Cannot be determined

   Answer: A

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Explanation:
Group B contains 23 questions => Marks of group B = 46
Let the number of questions in A be x and in C be 77-x.
Marks of group A = x
So, x/(x+46+3*77-3x) >= 60%
=> 5x >= 3(277-2x)
=> 11x >= 831
=> x >= 75.54
=> x = 76 (min)
So, the possible number of questions in group C = 1.

Question 27

If group C contains 8 questions and group B carries at least 20% of the total marks, which of the following best describes the number of questions in group B?

A   11 or 12

B   12 or 13

C   13 or 14

D   14 or 15

   Answer: C

▶ Video Solution

Explanation:
Let the number of questions in group B be x.
So, number of questions in group A = 92-x
Marks of group B = 2x
2x/(92-x+2x+24) >= 20%
=> 10x >= 116+x
=> 9x >= 116
=> x >= 12.88
From the options, x can be 13 or 14

CAT Syllabus (Download PDF)

Instructions

An airline has a certain free luggage allowance and charges for excess luggage at a fixed rate per kg. Two passengers, Raja and Praja have 60 kg of luggage between them, and are charged Rs 1200 and Rs 2400 respectively for excess luggage. Had the entire luggage belonged to one of them, the excess luggage charge would have been Rs 5400.

Question 28

What is the weight of Praja's luggage?

A   20 kg

B   25 kg

C   30 kg

D   35 kg

E   40 kg

    Answer: D

▶ Video Solution

Explanation:
Let the limit be x and the rate of charge be k per kg.
Let the excess luggage with Raja be R kg.
So, excess luggage with Praja = 2R kg
Now, excess luggage with Raja + excess luggage with Praja = 60 - 2x
So, 3R = 60 - 2x => R = 20 - 2x/3 which was charged 1200 Also, if one person had the entire luggage, excess luggage would have been 60 - x, which would have been charged 5400.
So the charge for the excess of $(20-\frac{2x}{3}) = k(20-\frac{2x}{3}) = 1200$ ....(1)
Also, the charge for the excess of 60-x = k(60-x) = 5400 .....(2)
Dividing (1) by (2), we get
$=> 3\times \frac{(60-2x)}{(60-x)} = \frac{1200}{5400}$

Solving this, x = 15 kg
So, Praja's luggage = 35 kg

Question 29

What is the free luggage allowance?

A   10 kg

B   15 kg

C   20 kg

D   25kg

E   30kg

    Answer: B

▶ Video Solution

Explanation:
Let the limit be x and the rate of charge be k per kg.
Let the excess luggage with Raja be R kg.
So, excess luggage with Praja = 2R kg
Now, excess luggage with Raja + excess luggage with Praja = 60 - 2x
So, 3R = 60 - 2x => R = 20 - 2x/3 which was charged 1200 Also, if one person had the entire luggage, excess luggage would have been 60 - x, which would have been charged 5400.
=> (60-2x)/3*(60-x) = 1200/5400
Solving this, x = 15 kg

Instructions
For the following questions answer them individually

Question 30

A telecom service provider engages male and female operators for answering 1000 calls per day. A male operator can handle 40 calls per day whereas a female operator can handle 50 calls per day. The male and the female operators get a fixed wage of Rs. 250 and Rs. 300 per day respectively. In addition, a male operator gets Rs. 15 per call he answers and a female operator gets Rs. 10 per call she answers. To minimize the total cost, how many male operators should the service provider employ assuming he has to employ more than 7 of the 12 female operators available for the job?

A   15

B   14

C   12

D   10

    Answer: D

▶ Video Solution

Explanation:
Let x be no. of male and y be no. of female operators.
We have 40x+50y=1000 .
So x = 25-(5*y/4) also 7<=y<=12.
So y can be 8 or 12.
If y=8 then x=15 and y=12 then x=10 .
Then we have to find total cost incurred in both the cases.
We find that cost is minimum in 2nd case when no. of males are 10.

Free Videos for CAT Preparation

Question 31

Every 10 years the Indian Government counts all the people living in the country. Suppose that the director of the census has reported the following data on two neighbouring villages Chota Hazri and Mota Hazri.

Chota Hazri has 4,522 fewer males than Mota Hazri.

Mota Hazri has 4,020 more females than males.

Chota Hazri has twice as many females as males.

Chota Hazri has 2,910 fewer females than Mota Hazri.

What is the total number of males in Chota Hazri?

A   11,264

B   14,174

C   5,632

D   10,154

    Answer: C

▶ Video Solution

Explanation:
Let the number of males in Mota Hazri = x
No. of males in Chota Hazri = x - 4522
Let the number of females in Mota Hazri = y
No. of females in Chota Hazri = y - 2910
(y - 2910) = 2(x - 4522) => y = 2x - 9044 + 2910 = 2x - 6134
Also y = x + 4020
So, x + 4020 = 2x - 6134 => x = 10154
So, number of males in Chota Hazri = 10154 - 4522 = 5632

Question 32

A change-making machine contains one-rupee, two-rupee and five-rupee coins. The total number of coins is 300. The amount is Rs. 960. If the numbers of one-rupee coins and two-rupee coins are interchanged, the value comes down by Rs. 40. The total number of five-rupee coins is

A 100

B 140

C 60

D 150

Answer: B

▶ Video Solution

Explanation:
Let the number of coins of the three denominations be x, y and z respectively.
x+y+z = 300
x+2y+5z = 960
2x+y+5z = 920
=> 3(x+y) + 10z = 1880
=> 3(300 - z) + 10z = 1880
=> 900 + 7z = 1880 => z = 980/7 = 140
So, the number of 5 rupee coins is 140

Question 33

Two full tanks, one shaped like a cylinder and the other like a cone, contain jet fuel. The cylindrical tank holds 500 litres more than the conical tank. After 200 litres of fuel has been pumped out from each tank the cylindrical tank contains twice the amount of fuel in the conical tank. How many litres of fuel did the cylindrical tank have when it was full?

A 700

B 1000

C 1100

D 1200

Answer: D

▶ Video Solution

Explanation:
Let the current capacity of conical flask be C. So, cylinder = C+500.

After pumping out 200 liters, C+300 = 2(C-200) => C = 700

So, full capacity of cylinder = 700+500 = 1200

CAT Percentile Predictor

Question 34

The owner of a local jewellery store hired three watchmen to guard his diamonds, but a thief still got in and stole some diamonds. On the way out, the thief met each watchman, one at a time. To each he gave 1/2 of the diamonds he had then, and 2 more besides. He escaped with one diamond. How many did he steal originally?

A 40

B 36

C 25

D None of these

Answer: B

Explanation:
Suppose the thief stole 'x' diamonds. \

After giving the share to the first watchman, the thief has (x/2)-2 diamonds.

After giving to the second watchman, the thief has (x/4)-3 diamonds.

After giving to the third watchman, the thief has (x/8)-(7/2) diamonds.

This is equal to 1. So, (x/8) - 7/2 = 1

Solving this equation, we get x = 36

Question 35

Mayank, Mirza, Little and Jaspal bought a motorbike for $60. Mayank paid one-half of the sum of the amounts paid by the other boys. Mirza paid one-third of the sum of the amounts paid by the other boys. Little paid one-fourth of the sum of the amounts paid by the other boys. How much did Jaspal have to pay?

A $15

B $13

C $17

D   None of these

Answer: B

Explanation:
Let the amount paid by Mayank be x. So, amount paid by the other three = 2x

=> Total bill = x+2x = 3x = 60 => x = 20. So, Mayank paid 20

Similarly, amount paid by Mirza + 3*Amount paid by Mirza = 60

=> Amount paid by Mirza = 15

Amount paid by Little + 4*Amount paid by Little = 60

=> Amount paid by Little = 12

So, amount paid by Jaspal = 60 - (20+15+12) = 60 - 47 = $13

Question 36

A car rental agency has the following terms. If a car is rented for 5 hr or less, then, the charge is Rs. 60 per hour or Rs. 12 per kilometre whichever is more. On the other hand, if the car is rented for more than 5 hr, the charge is Rs. 50 per hour or Rs. 7.50 per kilometre whichever is more. Akil rented a car from this agency, drove it for 30 km and ended up playing Rs. 300. For how many hours did he rent the car?

A   4 hr

B   5 hr

C   6 hr

D   None of these

Answer: C

Explanation:

Suppose Akil drove the car for less than 5 hrs. In this case, by distance basis, Rs 360 should be charged. This is not the case.

So he dove for more than 5 hrs. Cost comes more using time basis; which is Rs 300, i.e. he used the car for 6 hours.

Important Verbal Ability Questions for CAT (Download PDF)

Question 37

A piece of string is 40 cm long. It is cut into three pieces. The longest piece is three times as long as the middle-sized and the shortest piece is 23 cm shorter than the longest piece. Find the length of the shortest piece.

A 27

B 5

C 4

D 9

Answer: C

▶ Video Solution

Explanation:

Let the longest piece be x
Shortest piece = x - 23
Middle-sized piece = x/3
So, x + x - 23 + x/3 = 40 => 7x/3 = 63 => x = 27
Shortest piece = 27 - 23 = 4

Question 38

Three travellers are sitting around a fire, and are about to eat a meal. One of them has 5 small loaves of bread, the second has 3 small loaves of bread. The third has no food, but has 8 coins. He offers to pay for some bread. They agree to share the 8 loaves equally among the three travellers, and the third traveller will pay 8 coins for his share of the 8 loaves. All loaves were the same size. The second traveller (who had 3 loaves) suggests that he will be paid 3 coins, and that the first traveller be paid 5 coins. The first traveller says that he should get more than 5 coins. How much should the first traveller get?

A 5

B 7

C 1

D None of these

Answer: B

▶ Video Solution

Explanation:

Suppose A, B and C have 5 pieces of bread, 3 pieces of bread and 8 coins respectively. Since in total there are 8 pieces of bread, each one should get around 2.66 bread. So A must give 2.33 part of his bread to C and B must give 0.33. Distributing the amount in the same ratio of bread contribution, A must get 7 coins and B must get 1 coin.

Question 39

Consider the following steps :
1. Put x = 1, y = 2
2. Replace x by xy
3. Replace y by y +1
4. If y = 5 then go to step 6 otherwise go to step 5.
5. Go to step 2
6. Stop Then the final value of x equals

A 1

B 24

C 120

D 720

   Answer: B

▶ Video Solution

Explanation:

1. x=1 ; y=2

2. x=2 ; y=3

3. x=6 ; y=4

4. x=24 ; y=5

Hence when y=5 , x will be 24

Data Interpretation for CAT Questions (download pdf)

Question 40

Iqbal dealt some cards to Mushtaq and himself from a full pack of playing cards and laid the rest aside. Iqbal then said to Mushtaq. "If you give me a certain number of your cards, I will have four times as many cards as you will have. If I give you the same number of cards, I will have thrice as many cards as you will have". Of the given choices, which could represent the number of cards with Iqbal?

A 9

B 31

C 12

D 35

   Answer: B

▶ Video Solution

Explanation:

Let's say Iqbal has x cards initially and Mushtaq has y number of cards initially.

So first Mushtaq gave t cards to Iqbal, hence (x+t) = 4(y-t)

Now second time, Iqbal gave t cards to Mushtaq, hence x-t = 3(y+t)

Solving above two equations we will get x=31t and y=9t

And we know x+y<52 hence 40t<52

because t should be a whole number it will be 1 here and x=31 and y=9

Question 41

I bought 5 pens, 7 pencils and 4 erasers. Rajan bought 6 pens, 8 erasers and 14 pencils for an amount which was half more what I had paid. What per cent of the total amount paid by me was paid for the pens?

A   37.5%

B   62.5%

C   50%

D   None of these

    Answer: B

▶ Video Solution

Explanation:

Let the cost of pen, pencil and eraer be x,y,z respectively

5x+7y+4z = A

6x+8z+14y = 3A/2

4x + 16/3 z + 28/3 y = A

Comparing two equations

5x+7y+4z = 4x+16/3 z + 28/3 y

x = 7/3 y + 4/3 z

3x = 7y+4z

Now required percentage = $\frac{5x}{5x+7y+4z} \times 100 = \frac{5x}{5x+3x} = 62.5\%$

Question 42

Out of two-thirds of the total number of basketball matches, a team has won 17 matches and lost 3 of them. What is the maximum number of matches that the team can lose and still win more than three- fourths of the total number of matches, if it is true that no match can end in a tie?

A   4

B   6

C   5

D   3

    Answer: A

▶ Video Solution

Explanation:
Total matches played = 17+3 = 20

Total matches = 20*$\frac{3}{2}$ = 30

Number of wins required = 75% of 30 = 22.5 = 23 wins

23-17 = 6 more wins are required out of 10 matches to maintain 75% win recor which means there would be 4 losses.

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