

# Algebra related Questions of NTS GAT & NAT

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If  $3^x - 3^{x-1} = 18$ , then the value of  $x^x$  is :

$x^x$

A. 3

B. 8

✓ C. 27

D. 216

$$3 \times 3 \times 3 \\ 3^3 = 27$$

$$a = 27$$

$$3^x = 27$$

$$3^x = 3^3$$

$$\boxed{x = 3} \quad x^x = 3^3 = 3 \times 3 \times 3 \\ = 27$$

$$3^x - 3^{x-1} = 18$$

$$3^{x-1} = 3^x \cdot 3^{-1}$$

$$3^x - 3^x \cdot 3^{-1} = 18$$

$$3^x - \frac{3^x}{3} = 18 \dots (i)$$

$$a = 3^x \dots (ii)$$

$$a - \frac{a}{3} = 18$$

$$\frac{3a - a}{3} = 18 \Rightarrow 2a = 18 \times 3$$

$$2a = 54$$

$$\boxed{a = \frac{54}{2} = 27}$$

If  $2^x - 2^{x-1} = 16$ , then the value of  $x^2$  is :

A. 4

B. 9

C. 16

✓ D. 25

$$\frac{2 \times 2 \times 2 \times 2 \times 2}{25} = 32$$

$$2^x - 2^{x-1} = 16$$

$$2^x - 2^x \cdot 2^{-1} = 16$$

$$2^x - \frac{2^x}{2} = 16 \dots (i)$$

$$2^x = a \dots (ii)$$

$$a - \frac{a}{2} = 16$$

$$\frac{2a - a}{2} = 16 \Rightarrow \frac{a}{2} = 16 \Rightarrow a = 16 \times 2 = 32$$

$a = 32$

$$2^{x-1} = 2^x \cdot 2^{-1}$$

$$2^{-1} = \frac{1}{2}$$

$$2^x = 32$$

$$2^x = 2^5$$

$x = 5$

$$x^2 = 5^2 = 25$$

If  $5^x /_{125} = 1$ , then  $x$  is equal to :

Option:

A. 5

B. 2

C. 0

✓ D. 3

$$\frac{5^x}{125} = 1$$

$$5^x = 125$$

$$5^x = 5^3$$

$$\boxed{x = 3}$$

$$\begin{aligned} 5 \times 5 \times 5 \\ 25 \times 5 = 125 \\ 5^3 = 125 \end{aligned}$$

if  $x+y=7$  and  $xy = 12$ ,  
the value of  $(x^2+y^2)$  is :

Option :

A. 25

B. 29

C. 37

D. 49

$$(x+y)^2 = x^2 + y^2 + 2xy$$

$$(7)^2 = x^2 + y^2 + 2(12)$$

$$49 = x^2 + y^2 + 24$$

$$49 - 24 = x^2 + y^2$$

$$\boxed{25 = x^2 + y^2}$$

If  $(x + 1/x) = 3$ , then  $(x^2 + 1/x^2)$  is equal to:

$$(a+b)^2 = a^2 + b^2 + 2ab$$

$$a = x$$

$$b = 1/x$$

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

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

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

$$9 = x^2 + \frac{1}{x^2} + 2$$

$$9 - 2 = x^2 + \frac{1}{x^2}$$

$$\boxed{7 = x^2 + \frac{1}{x^2}}$$

If  $(x^2 + 1/x^2) = 102$ , then  $(x - 1/x)$  is

$$(a-b)^2 = a^2 + b^2 - 2ab$$

$$a = x$$

$$b = 1/x$$

$$\left(x - \frac{1}{x}\right)^2 = \underbrace{x^2 + \frac{1}{x^2}}_{102} - 2(x)\left(\frac{1}{x}\right)$$

$$\left(x - \frac{1}{x}\right)^2 = 102 - 2$$

$$\left(x - \frac{1}{x}\right)^2 = 100$$

$$\boxed{x - \frac{1}{x} = 10}$$

$$\sqrt{\left(x - \frac{1}{x}\right)^2} = \sqrt{100}$$

$$\boxed{x - \frac{1}{x} = \pm 10}$$



If  $a + b + c = 0$ , then  $(a^3 + b^3 + c^3)$  is equal to :

$$(a+b+c)^3 = a^3 + b^3 + c^3 + 3(a+b)(b+c)(c+a) \dots \text{ (i)}$$

$$a+b+c=0, \Rightarrow a+b = -c \dots \text{ (ii)}$$

$$a+c = -b \dots \text{ (iii)}$$

$$c+b = -a \dots \text{ (iv)}$$

$$0^3 = a^3 + b^3 + c^3 + 3(-c)(-a)(-b)$$

$$0 = a^3 + b^3 + c^3 - 3abc$$

$$\boxed{3abc = a^3 + b^3 + c^3}$$



A man spends 20% of his salary on clothes, 30% on rent, 25% on shopping, and still left with 1500. Find his net salary?

$$\text{Total spent (\%)} = 20 + 30 + 25 = 75\%$$

$$\text{Left (\%)} = 25\%$$

net salary

$$25\% \text{ of net salary} = 1500$$

$$\frac{25}{100}x = 1500$$

$$\boxed{x = 6000}$$

$$25x = 1500 \times 100$$

$$x = \frac{1500 \times 100}{25} = 1500 \times 4 = 6000$$

A box contains 785 balls whose colors are red, white and blue. The red and white together are 605, and white and blue together are 471. How many of them are white?

- A) 291
- B) 180
- C) 314
- D) 219

$$R + W + B = 785 \dots (i) \rightarrow$$

$$R + W = 605 \dots (ii)$$

$$W + B = 471$$

$$W + 180 = 471$$

$$W = 471 - 180$$

$$\boxed{W = 291}$$

$$605 + B = 785$$

$$B = 785 - 605 = 180$$

$$\boxed{B = 180}$$

If X is 20% of Y and Y is 30% of Z,  
what percent of Z is X?

$$X = \frac{20}{100} Y \dots (i)$$

$$Y = \frac{30}{100} Z \dots (ii)$$

$$X = \frac{20}{100} \cdot \frac{30}{100} Z$$

$$X = \frac{6}{100} Z$$

X is 6% of Z ✓

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## PAST PAPER Comprehension Paragraphs



There are 27 students on the collage debate team. What is the probability that at least 3 of them have their birthdays in the same month?

- A. 0
- B.  $3/27$
- C.  $3/12$
- D.  $1/2$
- ☒ E. 1

(1)

27  
months = 12

Jan = 2.7

Jan 20 Feb 7

Jan 3 Feb 3 ... 3

December 27

2 → 24

3 students

**Solution:** If there were no month in which at least 3 students had a birthday, then each month would have the birthdays of at most 2 students. But that's not possible. Even if there were 2 birthdays in January, 2 in February, ....., and 2 in December, that would account for only 24 students. It is guaranteed that with more than 24 students, at least one month will have 3 or more birthdays. The probability is one

**The sum of the ages of 5 children born at the intervals of 3 years each is 50 years. what is the age of the youngest child?**

Let age of youngest child =  $x$

$x+3, x+6, x+9, x+12$

$$x + x+3 + x+6 + x+9 + x+12 = 50$$

$$5x + 30 = 50$$

$$5x = 50 - 30$$

$$5x = 20$$

$$x = \frac{20}{5} = 4$$

$x = 4$  years

**Find two numbers whose sum is 24  
and whose product is 135**

$$x+y=24 \dots \text{ii)} \quad y=24-x \dots \text{vi)}$$

$$xy = 135$$

$$x(24-x) = 135$$

$$24x - x^2 = 135$$

$$x^2 - 24x + 135 = 0$$

$$x^2 - 9x - 15x + 135 = 0$$

$$x(x-9) - 15(x-9) = 0$$

$$(x-9)(x-15) = 0$$

$$x = 9 \text{ or } x = 15$$

$x, y$

$(9, 15)$

if  $x = 9$ ,

$$y = 24 - 9 = 15$$

!

$$\begin{matrix} -9, -15 \\ \searrow \end{matrix} = +24$$

$$135$$

**Area of square is  $900\text{m}^2$ . Find its perimeter**

$$A = L^2$$

$$L^2 = 900 \Rightarrow L = \sqrt{900} = L = 30\text{m}$$

$$P = 4L = 4 \times 30 = 120\text{m}$$

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### **Paragraphs**



If  $S_1$  is the sum of integers from 1 to 60 and  $S_2$  is the sum of integers from 61 to 100, what is the value of  $S_2 - S_1$ ?

$$S_1 = \frac{n(n+1)}{2} = \frac{\cancel{60}^{30}(60+1)}{\cancel{2}_1} = 30(61) = \underline{1830}$$

$$S_2 = \frac{n}{2} \{ 2a_1 + (n-1)d \}, \quad n=40, \quad d=1, \quad a_1=61$$

$$S_2 = \frac{40}{2} \{ 2(61) + 39(1) \}$$

$$S_2 = 20 \{ 122 + 39 \} = 20 \{ 161 \} = \underline{3220}$$

$$S_2 - S_1 = 3220 - 1830$$

$$\boxed{S_2 - S_1 = 1390}$$



train 100 meters long passes through a bridge at a rate of 72km/hr in 25 seconds. What is the length of the bridge?

400m b) 170m C) 600m D) None of above

$$V = 72 \text{ km/hr}$$

$$V = 72 \times \frac{1000 \text{ m}}{3600 \text{ sec}}$$

$$V = 20 \text{ m/sec}$$

$$1 \text{ km} = 1000 \text{ m}$$

$$1 \text{ hr} = 3600 \text{ sec}$$

$$S = vt \Rightarrow d = vt \Rightarrow d = 20 \frac{\text{m}}{\text{sec}} \times 25 \text{ sec}$$

$$d = 500 \text{ m}$$

length of bridge

train 100 meters long passes through a bridge at a  
rate of 72km/hr in 25 seconds. What is the length of the  
bridge?

400m

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None of above

$$1 \text{ km} = 1000 \text{ m}$$
$$1 \text{ hr} = 3600 \text{ sec}$$

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$$V = 20 \text{ m/sec}$$

$$S = vt \Rightarrow d = vt \Rightarrow d = 20 \frac{\text{m}}{\text{sec}} \times 25 \text{ sec}$$

$$d = 500 \text{ m}$$

$$\text{length of bridge} = 500 \text{ m} - 100 \text{ m}$$
$$= 400 \text{ m}$$





The product of two number is 600. Their LCM is 60.  
find their HCF

$$\text{Product of 2 number} = \text{LCM} \times \text{HCF}$$

$$600 = 60 \times \text{HCF}$$

$$\frac{600}{60} = \text{HCF}$$

$$10 = \text{HCF}$$

$$\boxed{\text{HCF} = 10}$$

THE LCM OF TWO NUMBERS IS 14 TIMES THEIR HCF. THE SUM OF LCM AND HCF IS 600. If one number is 280, then the other number is

a) 50 b) 100 c) 80 d) cannot be found

$$\text{LCM} = 14 \text{ HCF} \Rightarrow \text{LCM} = 14 \times 40 = 560$$

$\text{LCM} = 560$

$$\text{LCM} + \text{HCF} = 600 \dots \text{ii}$$

$$14\text{HCF} + \text{HCF} = 600$$
$$15\text{HCF} = 600 \Rightarrow \text{HCF} = \frac{600}{15} = 40$$

$\text{H.C.F} = 40$

Let other number be  $x$

$$\text{Product of 2 number} = \text{HCF} \times \text{LCM}$$

$$280 \times x = 40 \times 560$$
$$280x = 40 \times 560$$
$$x = \frac{40 \times 560}{280}$$

In an election, 20% of the votes were invalid. The election was held between two candidates. Candidate A got 55% of the total valid votes, If the total number of votes was 7500, the number of valid votes that the candidate B got is?

$$\begin{aligned} \downarrow \quad \text{Total valid votes} &= 80\% \times 7500 \\ \underline{2700} \quad \text{Total valid votes} &= \frac{80}{100} \times 7500 = 6000 \\ \text{B got } 45\% \text{ of Total valid votes} \\ &= \frac{45}{100} \times 6000 = \underline{2700} \text{ votes} \end{aligned}$$



There are 6 green balls and 8 red balls in a basket. A ball is drawn at random. What is the probability of getting a red ball?

$$\text{Total balls} = 6 + 8 = 14$$

$$\text{Red balls} = 8$$

$$= \frac{8}{14} = \frac{4}{7}$$

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# Question-1

- Average of first 150 natural numbers?
- Formula is  $(n+1)/2$
- So  $(151)/2=75.5$



## Question-3

- The ratio of circumference of a circle to its radius?  $2\pi$

$$C = 2\pi r \quad , \quad r = \text{radius}$$

$$\frac{2\pi r}{r} = 2\pi$$

## Question-4

$$\frac{1}{x} + \frac{1}{y} = \frac{1}{z}$$

If  $xy = z$  then find the value of  $x+y$ ?

$$\frac{1}{x} + \frac{1}{y} = \frac{1}{z}$$

$$\frac{y+x}{xy} = \frac{1}{z}$$

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

## Question-5

- A Quadrilateral has sides in ratio 2:3:6:7. The ratio of angles of these sides are?

4 sided =  $(n-2) = 2 \Delta s = 2 \times 180 = \underline{360^\circ}$   
 $\leq$  " =  $3 \Delta s = 540^\circ$

$2x, 3x, 6x, 7x$   
 $\boxed{18x} = 360^\circ$   
 $\boxed{x = 20^\circ}$   
 $2 \times 20 = 40^\circ$

$(n-2) \times 180^\circ$   
 $(4-2) \times 180^\circ$   
 $= 360^\circ$

## Question-7

- If  $5^a \times 5^b = 5^c / 5^d$  then express  $d$  in terms of  $a$ ,  $b$  and  $c$ ?

$$5^{a+b} = 5^{c-d}$$

$$a+b = c-d$$

$$a+b-c = -d$$

$$-a-b+c = d$$

## Question-12

The ratio of a to b is 5:7- If there are total 144, how many are a and b?

$$a = 5x = 5 \times 12 = 60$$

$$b = 7x = 7 \times 12 = 84$$

$$12x = 144$$

$$\boxed{x = 12}$$

## Question-14

The H.C.F of two numbers is 34 and L.C.M is 4284. If one number is 204, what is the other number?

## Question-14

The H.C.F of two numbers is 34 and L.C.M is 4284  
204, what is the other number?

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Product of any two number = H.C.F  $\times$  L.C.M

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(204) (x)

x =

$$\frac{34 \times 4284}{204}$$

