

Book For
Maharashtra Public Service Commission



MPSC Sub Inspector Mathematics Sample Paper



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(1)

If $\log \frac{a}{b} + \log \frac{b}{a} = \log (a + b)$, then:

[A] $a + b = 1$

[B] $a - b = 1$

[C] $a = b$

[D] $a^2 - b^2 = 1$

Answer : [A]

Explanation:

$$\log \frac{a}{b} + \log \frac{b}{a} = \log (a + b)$$

$$\Rightarrow \log (a + b) = \log \left(\frac{a}{b} \times \frac{b}{a} \right) = \log 1.$$

So, $a + b = 1$.

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(2)

$\frac{\log 8}{\log 8}$ is equal to:

[A]

$\frac{1}{8}$

[B]

$\frac{1}{4}$

[C]

$\frac{1}{2}$

[D]

$\frac{1}{8}$

Answer : [C]

Explanation:

$$\frac{\log 8}{\log 8} = \frac{\log (8)^{1/2}}{\log 8} = \frac{\frac{1}{2} \log 8}{\log 8} = \frac{1}{2}.$$

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(3) If $\log 27 = 1.431$, then the value of $\log 9$ is:

[A] 0.934

[B] 0.945

[C] 0.954

[D] 0.958

Answer : [C]

Explanation:

$$\log 27 = 1.431$$

$$\Rightarrow \log (3^3) = 1.431$$

$$\Rightarrow 3 \log 3 = 1.431$$

$$\Rightarrow \log 3 = 0.477$$

$$\therefore \log 9 = \log(3^2) = 2 \log 3 = (2 \times 0.477) = 0.954.$$

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(4)

If $\log_{10} 7 = a$, then $\log_{10} \left(\frac{1}{70} \right)$ is equal to:

[A] $-(1 + a)$

[B] $(1 + a)^{-1}$

[C]
 $\frac{a}{10}$

[D]
 $\frac{1}{10a}$

Answer : [A]

Explanation:

$$\begin{aligned}\log_{10} \left(\frac{1}{70} \right) &= \log_{10} 1 - \log_{10} 70 \\ &= -\log_{10} (7 \times 10) \\ &= -(\log_{10} 7 + \log_{10} 10) \\ &= -(a + 1).\end{aligned}$$

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(5) If $\log_{10} 2 = 0.3010$, the value of $\log_{10} 80$ is:

[A] 1.6020

[B] 1.9030

[C] 3.9030

[D] None of these

Answer : [B]

Explanation:

$$\begin{aligned}\log_{10} 80 &= \log_{10} (8 \times 10) \\ &= \log_{10} 8 + \log_{10} 10 \\ &= \log_{10} (2^3) + 1 \\ &= 3 \log_{10} 2 + 1 \\ &= (3 \times 0.3010) + 1 \\ &= 1.9030.\end{aligned}$$

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(6) If $\log 2 = 0.30103$, the number of digits in 2^{64} is:

[A] 18

[B] 19

[C] 20

[D] 21

Answer : [C]

Explanation:

$$\begin{aligned}\log (2^{64}) &= 64 \times \log 2 \\ &= (64 \times 0.30103) \\ &= 19.26592\end{aligned}$$

Its characteristic is 19.

Hence, then number of digits in 2^{64} is 20.

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(7) A vendor bought toffees at 6 for a rupee. How many for a rupee must he sell to gain 20%?

- [A] 3
[B] 4
[C] 5
[D] 6

Answer : [C]

Explanation:

C.P. of 6 toffees = Re. 1

S.P. of 6 toffees = 120% of Re. 1 = Rs. $\frac{6}{5}$

For Rs. $\frac{6}{5}$, toffees sold = 6.

For Re. 1, toffees sold = $\left(6 \times \frac{5}{6}\right) = 5$.

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(8) The percentage profit earned by selling an article for Rs. 1920 is equal to the percentage loss incurred by selling the same article for Rs. 1280. At what price should the article be sold to make 25% profit?

- [A] Rs. 2000
[B] Rs. 2200
[C] Rs. 2400
[D] Data inadequate

Answer : [A]

Explanation:

Let C.P. be Rs. x .

Then, $\frac{1920 - x}{x} \times 100 = \frac{x - 1280}{x} \times 100$

$\Rightarrow 1920 - x = x - 1280$

$\Rightarrow 2x = 3200$

$\Rightarrow x = 1600$

\therefore Required S.P. = 125% of Rs. 1600 = Rs. $\left(\frac{125}{100} \times 1600\right) = \text{Rs. } 2000$.

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(9) A shopkeeper expects a gain of 22.5% on his cost price. If in a week, his sale was of Rs. 392, what was his profit?

- [A] Rs. 18.20
[B] Rs. 70
[C] Rs. 72
[D] Rs. 88.25

Answer : [C]

Explanation:

C.P. = Rs. $\left(\frac{100}{122.5} \times 392\right) = \text{Rs. } \left(\frac{1000}{1225} \times 392\right) = \text{Rs. } 320$

\therefore Profit = Rs. $(392 - 320) = \text{Rs. } 72$.

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(10) Sam purchased 20 dozens of toys at the rate of Rs. 375 per dozen. He sold each one of them at the rate of Rs. 33. What was his percentage profit?

- [A] 3.5
- [B] 4.5
- [C] 5.6
- [D] 6.5

Answer : [C]

Explanation:

$$\text{Cost Price of 1 toy} = \text{Rs. } \left(\frac{375}{12} \right) = \text{Rs. } 31.25$$

$$\text{Selling Price of 1 toy} = \text{Rs. } 33$$

$$\text{So, Gain} = \text{Rs. } (33 - 31.25) = \text{Rs. } 1.75$$

$$\therefore \text{Profit \%} = \left(\frac{1.75}{31.25} \times 100 \right) \% = \frac{28}{5} \% = 5.6\%$$

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(11) A man buys a cycle for Rs. 1400 and sells it at a loss of 15%. What is the selling price of the cycle?

- [A] Rs. 1090
- [B] Rs. 1160
- [C] Rs. 1190
- [D] Rs. 1202

Answer : [C]

Explanation:

$$\text{S.P.} = 85\% \text{ of Rs. } 1400 = \text{Rs. } \left(\frac{85}{100} \times 1400 \right) = \text{Rs. } 1190$$

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(12) A boat can travel with a speed of 13 km/hr in still water. If the speed of the stream is 4 km/hr, find the time taken by the boat to go 68 km downstream.

- [A] 2 hours
- [B] 3 hours
- [C] 4 hours
- [D] 5 hours

Answer : [C]

Explanation:

$$\text{Speed downstream} = (13 + 4) \text{ km/hr} = 17 \text{ km/hr.}$$

$$\text{Time taken to travel 68 km downstream} = \left(\frac{68}{17} \right) \text{ hrs} = 4 \text{ hrs.}$$

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(13) A motorboat, whose speed in 15 km/hr in still water goes 30 km downstream and comes back in a total of 4 hours 30 minutes. The speed of the stream (in km/hr) is:

- [A] 4
- [B] 5
- [C] 6
- [D] 10

Answer : [B]

Explanation:

Let the speed of the stream be x km/hr. Then,

Speed downstream = $(15 + x)$ km/hr,

Speed upstream = $(15 - x)$ km/hr.

$$\therefore \frac{30}{(15 + x)} + \frac{30}{(15 - x)} = 4\frac{1}{2}$$

$$\Rightarrow \frac{900}{225 - x^2} = \frac{9}{2}$$

$$\Rightarrow 9x^2 = 225$$

$$\Rightarrow x^2 = 25$$

$$\Rightarrow x = 5 \text{ km/hr.}$$

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(14) A boat takes 90 minutes less to travel 36 miles downstream than to travel the same distance upstream. If the speed of the boat in still water is 10 mph, the speed of the stream is:

[A] 2 mph

[B] 2.5 mph

[C] 3 mph

[D] 4 mph

Answer : [A]

Explanation:

Let the speed of the stream x mph. Then,

Speed downstream = $(10 + x)$ mph,

Speed upstream = $(10 - x)$ mph.

$$\therefore \frac{36}{(10 - x)} - \frac{36}{(10 + x)} = \frac{90}{60}$$

$$\Rightarrow 72x \times 60 = 90(100 - x^2)$$

$$\Rightarrow x^2 + 48x - 100 = 0$$

$$\Rightarrow (x + 50)(x - 2) = 0$$

$$\Rightarrow x = 2 \text{ mph.}$$

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(15) A man can row at 5 kmph in still water. If the velocity of current is 1 kmph and it takes him 1 hour to row to a place and come back, how far is the place?

[A] 2.4 km

[B] 2.5 km

[C] 3 km

[D] 3.6 km

Answer : [A]

Explanation:

Speed downstream = $(5 + 1)$ kmph = 6 kmph.

Speed upstream = $(5 - 1)$ kmph = 4 kmph.

Let the required distance be x km.

$$\text{Then, } \frac{x}{6} + \frac{x}{4} = 1$$

$$\Rightarrow 2x + 3x = 12$$

$$\Rightarrow 5x = 12$$

$$\Rightarrow x = 2.4 \text{ km.}$$

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(16) A man takes twice as long to row a distance against the stream as to row the same distance in favour of the stream. The ratio of the speed of the boat (in still water) and the stream is:

[A] 2 : 1

[B] 3 : 1

[C] 3 : 2

[D] 4 : 3

Answer : [B]

Explanation:

Let man's rate upstream be x kmph.

Then, his rate downstream = $2x$ kmph.

$$\therefore (\text{Speed in still water}) : (\text{Speed of stream}) = \left(\frac{2x + x}{2}\right) : \left(\frac{2x - x}{2}\right)$$

$$= \frac{3x}{2} : \frac{x}{2}$$

$$= 3 : 1.$$

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(17) A train passes a station platform in 36 seconds and a man standing on the platform in 20 seconds. If the speed of the train is 54 km/hr, what is the length of the platform?

[A] 120 m

[B] 240 m

[C] 300 m

[D] None of these

Answer : [B]

Explanation:

$$\text{Speed} = \left(54 \times \frac{5}{18}\right) \text{m/sec} = 15 \text{ m/sec.}$$

Length of the train = $(15 \times 20) \text{m} = 300 \text{ m.}$

Let the length of the platform be x metres.

$$\text{Then, } \frac{x + 300}{36} = 15$$

$$\Rightarrow x + 300 = 540$$

$$\Rightarrow x = 240 \text{ m.}$$

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(18) The length of the bridge, which a train 130 metres long and travelling at 45 km/hr can cross in 30 seconds, is:

[A] 200 m

[B] 225 m

[C] 245 m

[D] 250 m

Answer : [C]

Explanation:

$$\text{Speed} = \left(45 \times \frac{5}{18}\right) \text{m/sec} = \left(\frac{25}{2}\right) \text{m/sec.}$$

Time = 30 sec.

Let the length of bridge be x metres.

$$\text{Then, } \frac{130 + x}{30} = \frac{25}{2}$$

$$\Rightarrow 2(130 + x) = 750$$

$$\Rightarrow x = 245 \text{ m.}$$

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(19) Two trains, each 100 m long, moving in opposite directions, cross each other in 8 seconds. If one is moving twice as fast the other, then the speed of the faster train is:

[A] 30 km/hr

[B] 45 km/hr

[C] 60 km/hr

[D] 75 km/hr

Answer : [C]

Explanation:

Let the speed of the slower train be x m/sec.

Then, speed of the faster train = $2x$ m/sec.

Relative speed = $(x + 2x)$ m/sec = $3x$ m/sec.

$$\therefore \frac{(100 + 100)}{8} = 3x$$

$$\Rightarrow 24x = 200$$

$$\Rightarrow x = \frac{25}{3}$$

So, speed of the faster train = $\frac{50}{3}$ m/sec

$$= \left(\frac{50}{3} \times \frac{18}{5} \right) \text{ km/hr}$$

$$= 60 \text{ km/hr.}$$

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(20) How many seconds will a 500 metre long train take to cross a man walking with a speed of 3 km/hr in the direction of the moving train if the speed of the train is 63 km/hr?

[A] 25

[B] 30

[C] 40

[D] 45

Answer : [B]

Explanation:

Speed of the train relative to man = $(63 - 3)$ km/hr

$$= 60 \text{ km/hr}$$

$$= \left(60 \times \frac{5}{18} \right) \text{ m/sec}$$

$$= \left(\frac{50}{3} \right) \text{ m/sec.}$$

$$\therefore \text{Time taken to pass the man} = \left(500 \times \frac{3}{50} \right) \text{ sec}$$

$$= 30 \text{ sec.}$$

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