Book For

Maharashtra Public Service Commission

MPSC Police Constable Mathematics Sample Paper

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(1) What percentage of numbers from 1 to 70 have 1 or 9 in the unit's digit?

[A] 1

[B] 14

[C] 20

[D] 21

Answer : [C]

Explanation:
Clearly, the numbers which have 1 or 9 in the unit's digit, have squares that end in the digit 1. Such numbers from 1 to 70 are 1, 9, 11, 19, 21, 29, 31, 39, 41, 49, 51, 59, 61, 69.
Number of such number =14
$\therefore$ Required percentage = $\left(\frac{14}{70} \times 100\right)\% = 20\%$.

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(2) If A = x% of y and B = y% of x, then which of the following is true?

[A] A is smaller than B.

[B] A is greater than B

[C] Relationship between A and B cannot be determined.

[D] If x is smaller than y, then A is greater than B.

[E] None of these

Answer : [E]

Explanation:
$x\%$ of $y = \left(\frac{x}{100} \times y\right) = \left(\frac{y}{100} \times x\right) = y\%$ of x

$\therefore$ A = B.

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(3) A batsman scored 110 runs which included 3 boundaries and 8 sixes. What percent of his total score did he make by running between the wickets?

[A] 45%

[B] $45\frac{5}{11}\%$

[C] $54\frac{6}{11}\%$

[D] 55%

Answer : [B]

Explanation:
Number of runs made by running = 110 - (3 x 4 + 8 x 6)
= 110 - (60)
= 50.
$\therefore$ Required percentage = $\left(\frac{50}{110} \times 100\right)\% = 45\frac{5}{11}\%$

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(4) A fruit seller had some apples. He sells 40% apples and still has 420 apples. Originally, he had:

[A] 588 apples

[B] 600 apples

[C] 672 apples

[D] 700 apples

Answer : [D]

Explanation:
Suppose originally he had x apples.
Then, (100 - 40)% of x = 420.
$\Rightarrow \frac{60}{100} \times x = 420$

$\Rightarrow x = \left(\frac{420 \times 100}{60}\right) = 700.$

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(5) If 20% of a = b, then b% of 20 is the same as:

[A] 4% of a

[B] 5% of a

[C] 20% of a

[D] None of these

Answer : [A]

Explanation:
20% of $a = b \Rightarrow \frac{20}{100}a = b.$

$\therefore$ b% of $20 = \left(\frac{b}{100} \times 20\right) = \left(\frac{20}{100}a \times \frac{1}{100} \times 20\right) = \frac{4}{100}a$ = 4% of a.

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(6) If $a - b = 3$ and $a^2 + b^2 = 29$, find the value of ab.

[A] 10

[B] 12

[C] 15

[D] 18

Answer : [A]

Explanation:
$2ab = (a^2 + b^2) - (a - b)^2$
$= 29 - 9 = 20$
$\Rightarrow ab = 10.$

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(7) To fill a tank, 25 buckets of water is required. How many buckets of water will be required to fill the same tank if the capacity of the bucket is reduced to two-fifth of its present ?

[A] 10

[B] 35

[C] 62.5

[D] Cannot be determined

[E] None of these

Answer : [C]

Explanation:
Let the capacity of 1 bucket = x.
Then, the capacity of tank = $25x$.
New capacity of bucket = $\frac{2}{5}x$

$\therefore$ Required number of buckets = $\frac{25x}{(2x/5)}$

$= \left(\frac{}{25x} \times \frac{5}{2x} \right)$

$= \frac{125}{2}$

$= 62.5$

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(8) A fires 5 shots to B's 3 but A kills only once in 3 shots while B kills once in 2 shots. When B has missed 27 times, A has killed:

[A] 30 birds

[B] 60 birds

[C] 72 birds

[D] 90 birds

Answer : [A]

Explanation:
Let the total number of shots be x. Then,
Shots fired by A = $\frac{5}{8}x$

Shots fired by B = $\frac{3}{8}x$

Killing shots by A = $\frac{1}{3}$ of $\frac{5}{8}x$ = $\frac{5}{24}x$

Shots missed by B = $\frac{1}{2}$ of $\frac{3}{8}x$ = $\frac{3}{16}x$

$\therefore$ $\frac{3x}{16} = 27$ or $x = \left(\frac{27 \times 16}{3} \right) = 144.$

Birds killed by A = $\frac{5x}{24} = \left(\frac{5}{24} \times 144 \right) = 30.$

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(9) A person crosses a 600 m long street in 5 minutes. What is his speed in km per hour?

[A] 3.6

[B] 7.2

[C] 8.4

[D] 10

Answer : [B]

Explanation:
Speed = $\left(\frac{600}{5 \times 60} \right)$ m/sec.

= 2 m/sec.
Converting m/sec to km/hr (see important formulas section)
= $\left(2 \times \frac{18}{5} \right)$ km/hr

= 7.2 km/hr.

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(10) A man complete a journey in 10 hours. He travels first half of the journey at the rate of 21 km/hr and second half at the rate of 24 km/hr. Find the total journey in km.

[A] 220 km

[B] 224 km

[C] 230 km

[D] 234 km

Answer : [B]

Explanation:

$\frac{(1/2)x}{21} + \frac{(1/2)x}{24} = 10$

$\Rightarrow \frac{x}{21} + \frac{x}{24} = 20$

$\Rightarrow 15x = 168 \text{ x } 20$

$\Rightarrow x = \left(\frac{168 \text{ x } 20}{15}\right) = 224$ km.

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(11) A man on tour travels first 160 km at 64 km/hr and the next 160 km at 80 km/hr. The average speed for the first 320 km of the tour is:

[A] 35.55 km/hr

[B] 36 km/hr

[C] 71.11 km/hr

[D] 71 km/hr

Answer : [C]

Explanation:

Total time taken $= \left(\frac{160}{64} + \frac{160}{80}\right)_{\text{hrs.}} = \frac{9}{2}$ hrs.

$\therefore$ Average speed $= \left(320 \text{ x } \frac{2}{9}\right)_{\text{km/hr}} = 71.11$ km/hr.

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(12) A car travelling with $\frac{5}{7}$ of its actual speed covers 42 km in 1 hr 40 min 48 sec. Find the actual speed of the car.

[A]
$17\frac{6}{7}$ km/hr

[B] 25 km/hr

[C] 30 km/hr

[D] 35 km/hr

Answer : [D]

Explanation:

Time taken = 1 hr 40 min 48 sec = 1 hr $40\frac{4}{5}$ min = $1\frac{51}{75}$ hrs = $\frac{126}{75}$ hrs.

Let the actual speed be x km/hr.

Then, $\frac{5}{7}x \text{ x } \frac{126}{75} = 42$

$\Rightarrow x = \left(\frac{42 \text{ x } 7 \text{ x } 75}{5 \text{ x } 126}\right) = 35$ km/hr.

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(13) In covering a distance of 30 km, Abhay takes 2 hours more than Sameer. If Abhay doubles his speed, then he would take 1 hour less than Sameer. Abhay's speed is:

[A] 5 kmph

[B] 6 kmph

[C] 6.25 kmph

[D] 7.5 kmph

Answer : [A]

Explanation:
Let Abhay's speed be x km/hr.
Then, $\frac{30}{x} - \frac{30}{2x} = 3$

$\Rightarrow 6x = 30$
$\Rightarrow x = 5$ km/hr.

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(14) Tea worth Rs. 126 per kg and Rs. 135 per kg are mixed with a third variety in the ratio 1 : 1 : 2. If the mixture is worth Rs. 153 per kg, the price of the third variety per kg will be:

[A] Rs. 169.50

[B] Rs. 170

[C] Rs. 175.50

[D] Rs. 180

Answer : [C]

Explanation:
Since first and second varieties are mixed in equal proportions.
So, their average price = Rs. $\left(\frac{126 + 135}{2}\right)$ = Rs. 130.50

So, the mixture is formed by mixing two varieties, one at Rs. 130.50 per kg and the other at say, Rs. x per kg in the ratio 2 : 2, *i.e.,* 1 : 1. We have to find x.
By the rule of alligation, we have:

Cost of 1 kg of 1st kind		Cost of 1 kg tea of 2nd kind
Rs. 130.50		Rs. x
	Mean Price Rs. 153	
$(x - 153)$		22.50

$\therefore \frac{x - 153}{22.50} = 1$

$\Rightarrow x - 153 = 22.50$
$\Rightarrow x = 175.50$

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(15) A vessel is filled with liquid, 3 parts of which are water and 5 parts syrup. How much of the mixture must be drawn off and replaced with water so that the mixture may be half water and half syrup?

[A] $\frac{1}{3}$

[B] $\frac{1}{4}$

[C] $\frac{1}{5}$

[D] $\frac{1}{7}$

Answer : [C]

Explanation:
Suppose the vessel initially contains 8 litres of liquid.
Let x litres of this liquid be replaced with water.

Quantity of water in new mixture = $\left(3 - \frac{}{8} + x\right)$ litres

Quantity of syrup in new mixture = $\left(5 - \frac{5x}{8}\right)$ litres

$\therefore \left(3 - \frac{3x}{8} + x\right) = \left(5 - \frac{5x}{8}\right)$

$\Rightarrow 5x + 24 = 40 - 5x$
$\Rightarrow 10x = 16$
$\Rightarrow x = \frac{8}{5}$.

So, part of the mixture replaced = $\left(\frac{8}{5} \times \frac{1}{8}\right) = \frac{1}{5}$.

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(16) In what ratio must a grocer mix two varieties of pulses costing Rs. 15 and Rs. 20 per kg respectively so as to get a mixture worth Rs. 16.50 kg?

[A] 3 : 7

[B] 5 : 7

[C] 7 : 3

[D] 7 : 5

Answer : [C]

Explanation:
By the rule of alligation:

Cost of 1 kg pulses of 1st kind		Cost of 1 kg pulses of 2nd kind
Rs. 15		Rs. 20
	Mean Price Rs. 16.50	
3.50		1.50

$\therefore$ Required rate = 3.50 : 1.50 = 7 : 3.

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(17) The cost of Type 1 rice is Rs. 15 per kg and Type 2 rice is Rs. 20 per kg. If both Type 1 and Type 2 are mixed in the ratio of 2 : 3, then the price per kg of the mixed variety of rice is:

[A] Rs. 18

[B] Rs. 18.50

[C] Rs. 19

[D] Rs. 19.50

Answer : [A]

Explanation:
Let the price of the mixed variety be Rs. x per kg.
By rule of alligation, we have:

Cost of 1 kg of Type 1 rice		Cost of 1 kg of Type 2 rice
Rs. 15		Rs. 20
	Mean Price Rs. x	
$(20 - x)$		$(x - 15)$

$\therefore \frac{(20 - x)}{(x - 15)} = \frac{2}{3}$

$\Rightarrow 60 - 3x = 2x - 30$
$\Rightarrow 5x = 90$
$\Rightarrow x = 18$.

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(18) Find the ratio in which rice at Rs. 7.20 a kg be mixed with rice at Rs. 5.70 a kg to produce a mixture worth Rs. 6.30 a kg.

[A] 1 : 3

[B] 2 : 3

[C] 3 : 4

[D] 4 : 5

Answer : [B]

Explanation:
By the rule of alligation:

Cost of 1 kg of 1st kind		Cost of 1 kg of 2nd kind
720 p		570 p
	Mean Price 630 p	
60		90

∴ Required ratio = 60 : 90 = 2 : 3.

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(19) A car owner buys petrol at Rs.7.50, Rs. 8 and Rs. 8.50 per litre for three successive years. What approximately is the average cost per litre of petrol if he spends Rs. 4000 each year?

[A] Rs. 7.98

[B] Rs. 8

[C] Rs. 8.50

[D] Rs. 9

Answer : [A]

Explanation:

$$\text{Total quantity of petrol consumed in 3 years} = \left(\frac{4000}{7.50} + \frac{4000}{8} + \frac{4000}{8.50}\right) \text{litres}$$

$$= 4000\left(\frac{2}{15} + \frac{1}{8} + \frac{2}{17}\right) \text{litres}$$

$$= \left(\frac{76700}{51}\right) \text{litres}$$

Total amount spent = Rs. (3 x 4000) = Rs. 12000.

$$\therefore \text{ Average cost} = \text{Rs.}\left(\frac{12000 \times 51}{76700}\right) = \text{Rs.}\ \frac{6120}{767} = \text{Rs. } 7.98$$

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(20) A library has an average of 510 visitors on Sundays and 240 on other days. The average number of visitors per day in a month of 30 days beginning with a Sunday is:

[A] 250

[B] 276

[C] 280

[D] 285

Answer : [D]

Explanation:
Since the month begins with a Sunday, to there will be five Sundays in the month.

$$\text{Required average} = \left(\frac{510 \times 5 + 240 \times 25}{30}\right)$$

$$= \frac{8550}{30}$$

$$= 285$$