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Maharashtra Public Service Commission

MPSC Sub Inspector Mathematics Sample Paper For Pre Exam

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(1) A, B and C can do a piece of work in 20, 30 and 60 days respectively. In how many days can A do the work if he is assisted by B and C on every third day?

[A] 12 days

[B] 15 days

[C] 16 days

[D] 18 days

Answer : [B]

Explanation:

A's 2 day's work = $\left(\dfrac{1}{20} \times 2\right) = \dfrac{1}{10}$.

(A + B + C)'s 1 day's work = $\left(\dfrac{1}{20} + \dfrac{1}{30} + \dfrac{1}{60}\right) = \dfrac{6}{60} = \dfrac{1}{10}$.

Work done in 3 days = $\left(\dfrac{1}{10} + \dfrac{1}{10}\right) = \dfrac{1}{5}$.

Now, $\dfrac{1}{5}$ work is done in 3 days.

∵ Whole work will be done in (3 x 5) = 15 days.

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(2) A alone can do a piece of work in 6 days and B alone in 8 days. A and B undertook to do it for Rs. 3200. With the help of C, they completed the work in 3 days. How much is to be paid to C?

[A] Rs. 375

[B] Rs. 400

[C] Rs. 600

[D] Rs. 800

Answer : [B]

Explanation:

C's 1 day's work = $\dfrac{1}{3} - \left(\dfrac{1}{6} + \dfrac{1}{8}\right) = \dfrac{1}{3} - \dfrac{7}{24} = \dfrac{1}{24}$.

A's wages : B's wages : C's wages = $\dfrac{1}{6} : \dfrac{1}{8} : \dfrac{1}{24} = 4 : 3 : 1$.

∵ C's share (for 3 days) = Rs. $\left(3 \times \dfrac{1}{24} \times 3200\right)$ = Rs. 400.

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(3) A can lay railway track between two given stations in 16 days and B can do the same job in 12 days. With help of C, they did the job in 4 days only. Then, C alone can do the job in:

[A]

$9\dfrac{1}{5}$ days

[B]

$9\dfrac{2}{5}$ days

[C]

$9\dfrac{3}{5}$ days

[D] 10

Answer : [C]

Explanation:

(A + B + C)'s 1 day's work = $\dfrac{-}{4}$,

A's 1 day's work = $\dfrac{1}{16}$,

B's 1 day's work = $\dfrac{1}{12}$.

∴ C's 1 day's work = $\dfrac{1}{4} - \left(\dfrac{1}{16} + \dfrac{1}{12} \right) = \left(\dfrac{1}{4} - \dfrac{7}{48} \right) = \dfrac{5}{48}$.

So, C alone can do the work in $\dfrac{48}{5} = 9\dfrac{3}{5}$ days.

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(4) A takes twice as much time as B or thrice as much time as C to finish a piece of work. Working together, they can finish the work in 2 days. B can do the work alone in:

[A] 4 days

[B] 6 days

[C] 8 days

[D] 12 days

Answer : [B]

Explanation:

Suppose A, B and C take x, $\dfrac{x}{2}$ and $\dfrac{x}{3}$ days respectively to finish the work.

Then, $\left(\dfrac{1}{x} + \dfrac{2}{x} + \dfrac{3}{x} \right) = \dfrac{1}{2}$

$\Rightarrow \dfrac{6}{x} = \dfrac{1}{2}$

$\Rightarrow x = 12$.

So, B takes (12/2) = 6 days to finish the work.

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(5) X can do a piece of work in 40 days. He works at it for 8 days and then Y finished it in 16 days. How long will they together take to complete the work?

[A]

$13\dfrac{1}{3}$ days

[B] 15 days

[C] 20 days

[D] 26 days

Answer : [A]

Explanation:

Work done by X in 8 days = $\left(\dfrac{1}{40} \times 8 \right) = \dfrac{1}{5}$.

Remaining work = $\left(1 - \dfrac{1}{5} \right) = \dfrac{4}{5}$.

Now, $\dfrac{4}{5}$ work is done by Y in 16 days.

Whole work will be done by Y in $\left(16 \times \dfrac{5}{4} \right)$ = 20 days.

∴ X's 1 day's work = $\dfrac{1}{40}$, Y's 1 day's work = $\dfrac{1}{20}$.

(X + Y)'s 1 day's work = $\dfrac{1}{} + \dfrac{1}{} = \dfrac{3}{}$.

Hence, X and Y will together complete the work in $\left(\dfrac{\overline{\dfrac{40}{40} \quad \dfrac{40}{20}}}{3}\right) = \left(\dfrac{40}{3}\right) = 13\dfrac{1}{3}$ days.

(6) A and B can do a work in 8 days, B and C can do the same work in 12 days. A, B and C together can finish it in 6 days. A and C together will do it in :

[A] 4 days

[B] 6 days

[C] 8 days

[D] 12 days

Answer : [C]

Explanation:

(A + B + C)'s 1 day's work = $\dfrac{1}{6}$;

(A + B)'s 1 day's work = $\dfrac{1}{8}$;

(B + C)'s 1 day's work = $\dfrac{1}{12}$.

$\therefore$ (A + C)'s 1 day's work = $\left(2 \times \dfrac{1}{6}\right) - \left(\dfrac{1}{8} + \dfrac{1}{12}\right)$

$= \left(\dfrac{1}{3} - \dfrac{5}{24}\right)$

$= \dfrac{3}{24}$

$= \dfrac{1}{8}$.

So, A and C together will do the work in 8 days.

(7) 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 = $\left(\dfrac{14}{70} \times 100\right)\% = 20\%$.

(8) 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 $y = \left(\dfrac{x}{100} \times y\right) = \left(\dfrac{y}{100} \times x\right) = y\%$ of x

$\therefore$ A = B.

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(9) 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] $45\dfrac{5}{11}\%$

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

[D] 55%

Answer : [B]

Explanation:
Number of runs made by running = 110 - (3 x 4 + 8 x 6)
= 110 - (60)
= 50.

$\therefore$ Required percentage = $\left(\dfrac{50}{110} \times 100\right)\% = 45\dfrac{5}{11}\%$

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(10) Gauri went to the stationers and bought things worth Rs. 25, out of which 30 paise went on sales tax on taxable purchases. If the tax rate was 6%, then what was the cost of the tax free items?

[A] Rs. 15

[B] Rs. 15.70

[C] Rs. 19.70

[D] Rs. 20

Answer : [C]

Explanation:
Let the amount taxable purchases be Rs. x.

Then, 6% of $x = \dfrac{30}{100}$

$\Rightarrow x = \left(\dfrac{30}{100} \times \dfrac{100}{6}\right) = 5.$

$\therefore$ Cost of tax free items = Rs. [25 - (5 + 0.30)] = Rs. 19.70

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(11) Two tailors X and Y are paid a total of Rs. 550 per week by their employer. If X is paid 120 percent of the sum paid to Y, how much is Y paid per week?

[A] Rs. 200

[B] Rs. 250

[C] Rs. 300

[D] None of these

Answer : [B]

Explanation:

Let the sum paid to Y per week be Rs. z.

Then, $z + 120\%$ of $z = 550$.

$\Rightarrow z + \dfrac{120}{100}z = 550$

$\Rightarrow \dfrac{11}{5}z = 550$

$\Rightarrow z = \left(\dfrac{550 \times 5}{11}\right) = 250.$

(12) A and B together have Rs. 1210. If $\dfrac{4}{15}$ of A's amount is equal to $\dfrac{2}{5}$ of B's amount, how much amount does B have?

[A] Rs. 460

[B] Rs. 484

[C] Rs. 550

[D] Rs. 664

Answer : [B]

Explanation:

$\dfrac{4}{15}$ A $= \dfrac{2}{5}$ B

$\Rightarrow$ A $= \left(\dfrac{2}{5} \times \dfrac{15}{4}\right)$B

$\Rightarrow$ A $= \dfrac{3}{2}$ B

$\Rightarrow \dfrac{A}{B} = \dfrac{3}{2}$

$\Rightarrow$ A : B = 3 : 2.

$\therefore$ B's share = Rs. $\left(1210 \times \dfrac{2}{5}\right)$ = Rs. 484.

(13) Seats for Mathematics, Physics and Biology in a school are in the ratio 5 : 7 : 8. There is a proposal to increase these seats by 40%, 50% and 75% respectively. What will be the ratio of increased seats?

[A] 2 : 3 : 4

[B] 6 : 7 : 8

[C] 6 : 8 : 9

[D] None of these

Answer : [A]

Explanation:

Originally, let the number of seats for Mathematics, Physics and Biology be $5x$, $7x$ and $8x$ respectively.

Number of increased seats are (140% of $5x$), (150% of $7x$) and (175% of $8x$).

$\Rightarrow \left(\dfrac{140}{100} \times 5x\right)$, $\left(\dfrac{150}{100} \times 7x\right)$ and $\left(\dfrac{175}{100} \times 8x\right)$

$\Rightarrow 7x$, $\dfrac{21x}{2}$ and $14x$.

$\therefore$ The required ratio = $7x : \dfrac{21x}{2} : 14x$

$\Rightarrow 14x : 21x : 28x$

$\Rightarrow 2 : 3 : 4.$

(14) The sum of three numbers is 98. If the ratio of the first to second is 2 :3 and that of the second to the third is 5 : 8, then the second number is:

[A] 20

[B] 30

[C] 48

[D] 58

Answer : [B]

Explanation:
Let the three parts be A, B, C. Then,

A : B = 2 : 3 and B : C = 5 : 8 = $\left(5 \times \dfrac{3}{5}\right)$: $\left(8 \times \dfrac{3}{5}\right)$ = 3 : $\dfrac{24}{5}$

$\Rightarrow$ A : B : C = 2 : 3 : $\dfrac{24}{5}$ = 10 : 15 : 24

$\Rightarrow$ B = $\left(98 \times \dfrac{15}{49}\right)$ = 30.

(15) The salaries A, B, C are in the ratio 2 : 3 : 5. If the increments of 15%, 10% and 20% are allowed respectively in their salaries, then what will be new ratio of their salaries?

[A] 3 : 3 : 10

[B] 10 : 11 : 20

[C] 23 : 33 : 60

[D] Cannot be determined

Answer : [C]

Explanation:
Let A = $2k$, B = $3k$ and C = $5k$.

A's new salary = $\dfrac{115}{100}$ of $2k$ = $\left(\dfrac{115}{100} \times 2k\right)$ = $\dfrac{23k}{10}$

B's new salary = $\dfrac{110}{100}$ of $3k$ = $\left(\dfrac{110}{100} \times 3k\right)$ = $\dfrac{33k}{10}$

C's new salary = $\dfrac{120}{100}$ of $5k$ = $\left(\dfrac{120}{100} \times 5k\right)$ = $6k$

$\therefore$ New ratio $\left(\dfrac{23k}{10} : \dfrac{33k}{10} : 6k\right)$ = 23 : 33 : 60

(16) Out of 7 consonants and 4 vowels, how many words of 3 consonants and 2 vowels can be formed?

[A] 210

[B] 1050

[C] 25200

[D] 21400

[E] None of these

Answer : [C]

Explanation:
Number of ways of selecting (3 consonants out of 7) and (2 vowels out of 4)

= $(^7C_3 \times {^4C_2})$

= $\left(\dfrac{7 \times 6 \times 5}{3 \times 2 \times 1} \times \dfrac{4 \times 3}{2 \times 1}\right)$

= 210.

Number of groups, each having 3 consonants and 2 vowels = 210.
Each group contains 5 letters.
Number of ways of arranging 5 letters among themselves = 5!

$$= 5 \times 4 \times 3 \times 2 \times 1$$

$$= 120.$$

∴ Required number of ways = (210 x 120) = 25200.

(17) In how many different ways can the letters of the word 'CORPORATION' be arranged so that the vowels always come together?

[A] 810

[B] 1440

[C] 2880

[D] 50400

[E] 5760

Answer : [D]

Explanation:
In the word 'CORPORATION', we treat the vowels OOAIO as one letter.
Thus, we have CRPRTN (OOAIO).
This has 7 (6 + 1) letters of which R occurs 2 times and the rest are different.
Number of ways arranging these letters = $\dfrac{7!}{2!}$ = 2520.

Now, 5 vowels in which O occurs 3 times and the rest are different, can be arranged
in $\dfrac{5!}{3!}$ = 20 ways.

∴ Required number of ways = (2520 x 20) = 50400.

(18) From a group of 7 men and 6 women, five persons are to be selected to form a committee so that at least 3 men are there on the committee. In how many ways can it be done?

[A] 564

[B] 645

[C] 735

[D] 756

[E] None of these

Answer : [D]

Explanation:
We may have (3 men and 2 women) or (4 men and 1 woman) or (5 men only).
∴ Required number of ways = $(^{7}C_3 \times {}^{6}C_2) + (^{7}C_4 \times {}^{6}C_1) + (^{7}C_5)$

$$= \left(\frac{7 \times 6 \times 5}{3 \times 2 \times 1} \times \frac{6 \times 5}{2 \times 1} \right) + (^{7}C_3 \times {}^{6}C_1) + (^{7}C_2)$$

$$= 525 + \left(\frac{7 \times 6 \times 5}{3 \times 2 \times 1} \times 6 \right) + \left(\frac{7 \times 6}{2 \times 1} \right)$$

$$= (525 + 210 + 21)$$

$$= 756.$$

(19) A box contains 2 white balls, 3 black balls and 4 red balls. In how many ways can 3 balls be drawn from the box, if at least one black ball is to be included in the draw?

[A] 32

[B] 48

[C] 64

[D] 96

[E] None of these

Answer : [C]

Explanation:
We may have(1 black and 2 non-black) or (2 black and 1 non-black) or (3 black).

∴ Required number of ways $= ({}^3C_1 \times {}^6C_2) + ({}^3C_2 \times {}^6C_1) + ({}^3C_3)$

$$= \left(3 \times \frac{6 \times 5}{2 \times 1}\right) + \left(\frac{3 \times 2}{2 \times 1} \times 6\right) + 1$$

$$= (45 + 18 + 1)$$

$$= 64.$$

(20) In how many ways a committee, consisting of 5 men and 6 women can be formed from 8 men and 10 women?

[A] 266

[B] 5040

[C] 11760

[D] 86400

[E] None of these

Answer : [C]

Explanation:
Required number of ways $= ({}^8C_5 \times {}^{10}C_6)$

$$= ({}^8C_3 \times {}^{10}C_4)$$

$$= \left(\frac{8 \times 7 \times 6}{3 \times 2 \times 1} \times \frac{10 \times 9 \times 8 \times 7}{4 \times 3 \times 2 \times 1}\right)$$

$$= 11760.$$