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11. ![Diagram](image)

From plane mirror property
OM = IM = 3 m
So, OI = OM + MI = 3 + 3 = 6 m

36. 

\[(0.00243)^{15} = (0.3)^{5 - \frac{2}{5}} = 0.09\]

37. 

C.P. of 1 toy = Rs. \( \frac{375}{12} \) = Rs.31.25. S.P. of 1 kg = Rs. 33.

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

38. 

ATQ

\[2p = p \left(1 + \frac{R}{100} \right)^{10}\]

Corporate Office: CG Tower, A-48 & 52, IPIA, Near City Mall, Jhalawar Road, Kota (Raj.) – 324005
PCCP Head Office: Plot No. A-51 [A], IPIA, Near Resonance CG Tower
Contact: 6635569, 8824078330
Website: www.resonance.ac.in | E-mail: contact@resonance.ac.in
Toll Free: 1800 258 5555 | CIN: U80302RU2007PTC024029
\[
2^{\frac{1}{10}} = \left(1 + \frac{R}{100}\right)^{\frac{T}{10}}
\]

\[
8p = p \left(1 + \frac{R}{100}\right)^T
\]

\[
8 = \left(1 + \frac{R}{100}\right)^T
\]

\[
2^3 = \left(\frac{1}{2^{10}}\right)^T
\]

\[
2^3 = \frac{T}{10}
\]

\[
3 = \frac{T}{10}
\]

\[
T = 3 \times 10 = 30 \text{ years.}
\]

39. A’s 1 day work = \(\frac{1}{16}\) part

B’s 1 day work = \(\frac{1}{12}\) part

\[
(A + B)’s \ work \ in \ 2 \ days = \left(\frac{1}{12} + \frac{1}{16}\right) = \frac{7}{48}.
\]

1 day work = \(\frac{7}{96}\)

so work can be finished in \(\frac{96}{7} = 13 \frac{5}{7}\) days

40. \(a + b + \sqrt{ab}\)

Let \(n = a + b\)

\(\sqrt{ab} = y\)

So \(n – y\) is its Rationalisation

\((x + y)(x – y) = x^2 – y^2\)

\((a + b + \sqrt{ab}) (a + b – \sqrt{ab})\)

\((a + b)^2 – ab\)

which is rational so

\(a + b – \sqrt{ab}\) is the Ans.

41. Let the man purchases \(y\) kg of goods at Rs 1600.

Then his total CP = Rs 1600.

He sells \(\frac{3y}{4}\) kg of his goods at a profit of 10%.

Now, CP of \(\frac{3y}{4}\) kg of his goods

\[= Rs 1600 \times \frac{3}{4} = Rs 1200.\]

\[\therefore \ SP \ of \ \frac{3y}{4}\ \text{kg of his goods}\]

\[= Rs \frac{110}{100} \times 1200 = Rs 1320.\]
Now, CP of the remaining $\frac{y}{4}$ kg of his goods

= Rs $1600 \times \frac{1}{4}$ = Rs 400.

Let the man sell the remaining $\frac{y}{4}$ kg of his goods at a profit of $x\%$.

Then SP of $\frac{y}{4}$ kg of his good

= Rs $\frac{100+x}{100} \times 400$ = Rs $(400 + 4x)$

∴ Total SP of $y$ kg of goods

= Rs $(1320 + 400 + 4x)$

= Rs $(4x + 1720)$

If the man makes a gain of 16% on the whole transaction, then SP of $y$ kg of goods = Rs $\frac{116}{100} \times 1600$ = Rs 1856

∴ $4x + 1720 = 1856$

⇒ $4x = 1856 - 1720 = 136$

⇒ $x = \frac{136}{4} = 34$

Hence, the required profit = 34%

42. Let the required sum i.e. the principle, be Rs P.

We have, Principal = P. Amount = Rs 9826, R = $2 \frac{1}{2}$% per annum and

n = 18 months = $\frac{18}{12}$ years = $\frac{3}{2}$ years.

∴ $A = P\left(1 + \frac{R}{100}\right)^{2n}$

⇒ $9826 = P\left(1 + \frac{\frac{5}{2}}{200}\right)^{\frac{3}{2}}$

⇒ $9826 = P\left(1 + \frac{1}{80}\right)^{3}$

⇒ $9826 = P\left(\frac{81}{80}\right)^{3}$

⇒ $P = 9826 \times \left(\frac{80}{81}\right)^{3} = 9466.54$

Hence, required sum = Rs 9466.54

ALITER

Let the required sum be Rs 100. Then, the amount after 18 months i.e., $\frac{3}{2}$ years at the rate of $2 \frac{1}{2}$% compounded half-yearly, is given by
Amount = Rs \left[ 100 \times \left( 1 + \frac{5}{200} \right)^{\frac{3}{2}} \right] \\
= Rs \left[ 100 \times \left( \frac{81}{80} \right)^{\frac{3}{2}} \right] \\
= Rs \frac{531441}{5120} \\
Now, 
If amount is Rs. \frac{531441}{5120}, then principal = Rs 100 
If the amount is Re 1, then principal 
= Rs \left( \frac{100 \times 5120}{531441} \right) 
If the amount is Rs. 9826, then principal 
= Rs \left( \frac{100 \times 5120}{531441} \times 9826 \right) 
= Rs 9466.54 
Hence, required sum = Rs 9466.54 

43. A can do a piece of work in 'm' days 
In 1 day A can do \frac{1}{m} part of work 
B can do piece of work in 'n' days 
In 1 day B can do \frac{1}{n} part of work 
So, in 1 day both A and B can do 
= \left( \frac{1}{m} + \frac{1}{n} \right) part of work 
= \left( \frac{m+n}{mn} \right) part of work 
So, \left( \frac{m+n}{mn} \right) part of work in 1 day 
So, complete work is done by A and B 
= \frac{1}{1 day work} = \frac{mn}{m+n} days. 

44. \left(2^5\right)^\frac{1}{3} \times (5 \times 5 \times 5 \times 2)^\frac{1}{3} 
= \left(2^5 \times 5^3 \times 2\right)^\frac{1}{3} = \left(2^6 \times 5^3\right)^\frac{1}{3} 
= 2^2 \times 5 = 20 

45. Let his cost price be Rs. x 
Then his marked price =Rs \left( x + \frac{10x}{100} \right) = Rs \frac{11x}{10} 
He then sells it at a discount of 10% on this marked price.
46. Let principal be Rs. P then in 15 years it becomes 2P

\[ 2P = P \left(1 + \frac{r}{100}\right)^{15} \]

\[ \Rightarrow \left(1 + \frac{r}{100}\right)^{15} = 2 \quad \text{... (1)} \]

Now,

\[ 8P = P \left(1 + \frac{r}{100}\right)^{x} \]

\[ \Rightarrow 8 = \left(1 + \frac{r}{100}\right)^{x} \Rightarrow 2^{3} = \left(1 + \frac{r}{100}\right)^{x} \]

\[ \Rightarrow \left(1 + \frac{r}{100}\right)^{45} = \left(1 + \frac{r}{100}\right)^{x} \]

\[ \therefore \quad x = 45 \text{ years} \]

47. 12 men = 18 women \Rightarrow 8 men = \left(\frac{18}{12} \times 8\right) \text{ women} = 12 \text{ women.}

\[ \therefore \quad 8 \text{ men} + 16 \text{ women} = 28 \text{ women.} \]

Now, more women, less days.

\[ \therefore \quad 28 : 18 :: 14 : x. \]

So, \[ x = \frac{18 \times 14}{28} = 9 \text{ days.} \]

48. 

\[ \left(\frac{5}{3}\right)^{-5} \times \left(\frac{5}{3}\right)^{11} = \left(\frac{5}{3}\right)^{6x} \]

\[ \therefore \quad 6 + 11 = 8x \]

\[ 6 = 8x \]

\[ x = \frac{3}{4} \]

49. C.P. = Rs. 1200. S.P. = 125% of Rs.1200

\[ = \text{Rs.} \left(\frac{125}{100} \times 1200\right) = \text{Rs.} 1500. \]
Let marked price be Rs. x. Then, 80% of x = 1500
⇒ x = \( \frac{1500 \times 100}{80} \) = 1875
∴ Marked price = Rs. 1875

50. Case I
Compounded yearly
T = 3/2 years, R = 4%, P = Rs. 5000
A = P \( \left( 1 + \frac{r}{100} \right)^n \)
= 5000 \( \left( 1 + \frac{4}{100} \right)^{3/2} \)
= 5000 \( \left( \frac{26}{25} \right)^{1\frac{1}{2}} \)
= Rs. 5304
C.I. = A.P. = 5304 – 5000 = Rs. 304
Case II
Interest compounded half yearly
T = 3 half years, R = 27, P = Rs. 5000
A = P \( \left( 1 + \frac{2}{100} \right)^3 \)
= 5000 \( \left( \frac{51}{50} \right)^3 \)
= \( \frac{8000 \times 51 \times 51}{50 \times 50 \times 50} \)
= Rs. 5306.04
C.I. = A – P
= Rs.5306.04 – 5000
= Rs. 306.04
Difference = 306.04 – 304 = Rs. 2.04

51. Let A complete the work in x days
So, work done by A in 1 day = \( \frac{1}{x} \)
According to problem :
\[ \frac{1}{x} + \frac{1}{15} = \frac{1}{10} \]
\[ \frac{1}{x} = \frac{1}{10} - \frac{1}{15} \]
\[ \frac{1}{x} = \frac{3 - 2}{30} \]
x = 30
So, A complete the work in 30 days.

52. \( 2^n - 2^{n-1} = 4 \)
\[ 2^n = 8 \]
n = 3
53. S.P. of 1 article = Rs. 45. Let marked price of each article be Rs. x.

Then, \( x = 45 \Rightarrow x = Rs. \left( \frac{45 \times 100}{90} \right) \)

= Rs. 50.

C.P. = Rs. \( \left( \frac{100}{150} \times 45 \right) = Rs. 30 \)

Now, C.P. = Rs. 30, S.P. = Rs. 50.

\( \therefore \) Required profit\% = \( \left( \frac{20}{30} \times 100 \right) \% = 66 \frac{2}{3} \% \)

54. Difference = \( P \left( \frac{R}{100} \right)^n \)

\( 282 = P \left( \frac{10}{100} \right)^n \)

\( 282 \times 100 \times 100 = P \times 10 \times 10 \)

Rs. 28200 = P

55. A’s 1 day work = \( \frac{1}{40} \)

so A’s 5 day work = \( \frac{1}{8} \) part

work left = \( 1 - \frac{1}{8} = \frac{7}{8} \) part

Let B’s 1 day work = x

so \( \frac{21(x)}{7} = \frac{7}{8} \)

x = \( \frac{1}{24} \) part

(\( A + B \))’ 1 day work = \( \left( \frac{1}{24} + \frac{1}{40} \right) = \frac{1}{15} \)

so A and B can do the work in 15 days

56. S.I. = \( \frac{PRT}{100} \)

90 = \( \frac{PR \times 3}{100} \)

\( 90 \times 100 = PR \times 3 \)

3000 = PR

For 2 years

S.I. = \( \frac{PR \times 2}{100} \)

= Rs. 60

So, C.I. – S.I. = \( P \left( \frac{R}{100} \right)^n \)
63 – 60 = P \left( \frac{R}{100} \right)^2

3 = \frac{PR^2}{10000}
30000 = PR \times R
30000 = 3000 \times R
10% = R
So, PR = 3000
P \times 10 = 3000
P = Rs. 300

57. 5 men = 10 women
\ 1 \text{men} : \ 2 \text{women} \quad \ldots (i)
Let amount of job = x
so x = 6 \text{men} \times 10 \times 4
From (i) \ x = 12 \text{women} \times 10 \text{days} \times 4 \text{hrs}
\ x = 480
Let 10 women works for y days
so, x = 10 \text{women} \times 6 \text{hrs} \times y
\ x = 60y
60y = 480
y = 8 \text{days}

58. (A) 5 \times 10^{-1}
(B) 0.5 \times 10^{-1} = 5 \times 10^{-2}
(C) 0.05 \times 10 = 5 \times 10^{-1}
(D) 0.005 \times 10^2 = 5 \times 10^{-1}
So, a, c & d are same but b is not same

59. Let the C.P. be Rs. x.
1st S.P. = \frac{80x}{100} = \frac{4x}{5}
2nd S.P. = \frac{105x}{100} = \frac{21x}{20}
\therefore \quad \frac{21x}{20} - \frac{4x}{5} = 100
\Rightarrow \quad \frac{5x}{10} = 100
\ x = 400

60. Difference = P \left( \frac{R}{100} \right)^n
\frac{96}{15000} = \left( \frac{R}{100} \right)^2
\frac{4}{50} = \frac{R}{100}
\frac{4 \times 100}{50} = R
8% = R
61. 

(A + B)'s 1 day work = \(\frac{1}{30}\)

(B + C)'s 1 day work = \(\frac{1}{24}\)

(A + C)'s 1 day work = \(\frac{1}{20}\)

so,

\[
\left(\frac{1}{30} + \frac{1}{24} + \frac{1}{20}\right) = 2\left(\frac{1}{A} + \frac{1}{B} + \frac{1}{C}\right)
\]

so 1 day work A, B and C = \(\frac{1}{30} + \frac{1}{24} + \frac{1}{20}\)

so 10 day work of all three = \(5\left(\frac{1}{30} + \frac{1}{24} + \frac{1}{20}\right)\)

\(= \frac{5}{8}\) part

Remaining work = \(\frac{3}{8}\) part

1 day work of A = \(\frac{1}{16} - \frac{1}{24} = \frac{1}{48}\)

so the complete work done by A in 48 days.

so \(\frac{3}{8}\) part of work A can do in \(\frac{3}{8} \times 48 = 18\) days.

62. 

\[
\begin{align*}
\frac{x}{y} &\rightarrow \frac{a}{y} - \frac{b}{x} - c \\
\frac{y}{x} &\rightarrow \frac{a}{y} - \frac{b}{x} - c \\
\frac{y}{x} &\rightarrow \frac{a}{y} - \frac{b}{x} - c \\
\frac{y}{x} &\rightarrow \frac{a}{y} - \frac{b}{x} - c \\
\frac{y}{x} &\rightarrow 0
\end{align*}
\]

63. 

Suppose he buys 6 eggs of each kind.

C.P. of 12 eggs = Rs \(\frac{1}{2} \times 6 + \frac{2}{3} \times 6\) = Rs. 7.

S.P. of 12 eggs = Rs. \(\frac{3}{5} \times 12\) = Rs. 7.20

\(\therefore\) Gain\% = \(\frac{0.20}{7} \times 100\) % = \(2 \frac{6}{7}\) %.

64. 

Here, P = Rs. 4000, R_1 = 5\% per annum and R_2 = 15\% per annum.

Amount after 1 years

\[P\left(1 + \frac{R_1}{100}\right)\left(1 + \frac{R_2}{100}\right) = Rs\ 4000 \times \left(1 + \frac{5}{100}\right)\left(1 + \frac{15}{100}\right) = Rs\ 4000 \times \left(1 + \frac{1}{20}\right)\left(1 + \frac{3}{20}\right)\]
= Rs \(4000 \times \frac{21}{20} \times \frac{23}{20}\) = Rs 4830. Thus, the refrigerator will cost Rs 4830 to Ram Singh.

65. Work ratio of sakshi and tanya = 100 : 125 \(\Rightarrow\) 4 : 5
So time ratio = 5 : 4
Let tanya can complete work in \(x\) days
so, \(\frac{20}{x} = \frac{5}{4}\) \(\Rightarrow\) \(x = 16\) days

66. The sex of N is not given hence the exact relationship b/w N & P cannot be established.

67. S is sitting next to P so, the order S, P or P, S is followed. K is sitting next to R.
So the order R, K is followed because R is on the extreme left. T is not next to P or K.
So, the arrangement will be R, K, P, S, T.
Clearly, P and T are sitting adjacent to S.

69. On the basis of the information given in the question we have the sitting arrangements of the persons as per the fig. below.

70. His mother is the woman.
\(\therefore\) Woman is mother of the person.

Sol. (73 to 76): The best method to solve this question is to make a table and fill the place according to the information given logically. On analyzing the information given in the question, we arrive at the following table

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<tr>
<th>Student</th>
<th>Compulsory Subject</th>
<th>Optional Subject</th>
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<tr>
<td>M</td>
<td>Geography (given)</td>
<td>English (given)</td>
</tr>
<tr>
<td>N</td>
<td>Geography (given)</td>
<td>Biology (given)</td>
</tr>
<tr>
<td>O</td>
<td>Geography (given)</td>
<td>Physics (given)</td>
</tr>
<tr>
<td>P</td>
<td>English (given)</td>
<td>Geography (given) Female student (given)</td>
</tr>
<tr>
<td>Q</td>
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<td>Physics (given)</td>
</tr>
<tr>
<td>R</td>
<td>Physics (given)</td>
<td>Chemistry (given)</td>
</tr>
</tbody>
</table>

77. Number 5 represents those poor boys helping family business but are not educated or employed elsewhere because it occupies the space common to circle and rectangle only.

78. No number occupies the space which is common to circle, square and rectangle only.

79. Number 3 is present in the space common to circle, square and rectangle, hence represents educated poor boys who help in family business.

91. \(f = 1000\) Hz
\(\lambda = 50\) cm = .5 m
\(v = f \lambda = 1000 \times .5 = 500\) m/s
Time taken to travel distance of 500 m
\[ t = \frac{d}{v} = \frac{500}{500} = 1 \text{ s} \]

96. 
\[ 2^7 \times \left( \frac{1}{2} \right)^5 \times 2^{-6} \times \left( \frac{1}{2} \right)^{-3} \]
\[ = 2^7 \times 2^{-6} \times 2^{-6} \times 2^3 \]
\[ = 2^{-1} \times 2^{-6} \times 2^3 \]
\[ = \frac{1}{2} \]
\[ = \frac{1}{32} \]

97. Discount - I \(- 50\% \) [A]
Discount - II \(- 50\% \) [B]
Successive discount = A + B - \frac{AB}{100}
\[ = 50 + 50 - \frac{50 \times 50}{100} \]
\[ \Rightarrow 50 + 50 - 25 = 75\% \]

98. Let its orginal size be \( x \)
So, after tripling its size is \( 3x \)
Here \( p = x \), \( R = 25\% \)
\[ A = 3x \]
\[ 3x = x \left( 1 + \frac{R}{100} \right)^n \]
\[ \frac{3x}{x} = \left( 1 + \frac{R}{100} \right)^n \]
\[ 3 = \left( 1 + \frac{25}{100} \right)^n \]
\[ 3 = \left( \frac{5}{4} \right)^n \]
\[ \left( \frac{5}{3} \right)^{\frac{1}{3}} = \left( \frac{5}{4} \right)^n \]
\[ 3^{\frac{1}{3}} = \frac{5}{4} \]
So, \( 5 = n \)
So, it has to undergo reproduction 5 times
So, time taken will be \( 15 \times 5 = 75 \text{ min} \)

99. A's 1 day work = \( \frac{1}{20} \)
B's 1 day work = \( \frac{1}{15} \)
Let C's 1 day work = \( \frac{1}{C} \)
So, \[ 6 \left( \frac{1}{20} + \frac{1}{15} + \frac{1}{C} \right) \]
\[ = 4 \left( \frac{1}{20} + \frac{1}{C} \right) + 1 \]
\[ \Rightarrow \frac{27}{30} + \frac{4}{C} = 1 \]
\[ \Rightarrow \frac{4}{C} = \frac{3}{30} \]
\[
\frac{1}{C} = \frac{1}{40} \\

\frac{3}{8} \times \frac{P \times R \times 6}{100} = \frac{1}{4} \\
\frac{3 \times 100 \times 4}{25 \times 8} = R \\
R = 6\% 
\]