## Choose correct answer(s) from the given choices

(1) Saina invested in mutual funds. If that mutual fund offered an interest rate of $5 \%$ per annum compounded annually, then find the amount invested by Saina given that she got a total amount of 77175 from the funds after 2 years.
a. 20000
b. 7000
c. 5000
d. 70000
(2) The value of a property increases every year at the rate of $10 \%$. If its value at the end of $2 \%$ years is 532400 , what was its original value at the beginning of these years?
a. 550000
b. 790000
c. 440000
d. 680000

## Fill in the blanks

(3) The population of a town was 5600 four years back. It is 7000 right now. Four years down the line, if the rate of growth of the population has been constant over the years and has been compounding annually, the the population will be $\qquad$ .
(4) If an amount of 80000 is invested for 2 years such that the compound interest received for the first and the second year is $9 \%$ and $11 \%$ per annum respectively, then the value of interest received is
$\qquad$ and the value of final amount is $\qquad$

## Answer the questions

(5) Population of a town increases by $1 \%$ every year. If current population of the town is 80000 . Find the population of town after 2 years.
(6) Find the least number of complete years in which a sum of money put out at $30 \%$ compound interest will be more than doubled.
(7) At the beginning of the year 2005, a person invests some amount in a bank. At the beginning of 2010, the accumulated interest was 10000 and at the beginning of 2015 , the accumulated interest became 25000 . The interest rate is compounded annually and the annual interest rate is fixed. What is the principal amount?
(8) Number of workers in a factory increases by $20 \%$ every year. If there are 8000 workers in the factory, find the number of workers in factory after 2 years.
(9) Sarika invested 512000 in mutual funds. She is being offered $8 \frac{3}{4} \%$ interest per annum compounded annually. If Sarika takes out all her money from the funds at the end of 3 years. Find the amount of interest received by her.
(10) The population of a town was 10,000 three years ago. If it increased by $7.5 \%, 5 \%$, and $4 \%$ respectively in the last three years, then what is the present population of the town?
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## Solutions

(1) d. 70000

## Step 1

Let us assume that the sum is $P$.

## Step 2

Given:
Time $(n)=2$ years
$\operatorname{Rate}(R)=5 \%$
Amount $(A)=77175$

## Step 3

Now,

$$
\begin{gathered}
A=P \times\left(1+\frac{R}{100}\right)^{2} \\
\Longrightarrow 77175=P \times\left(1+\frac{5}{100}\right)^{2} \\
\Longrightarrow \\
77175=P \times\left(\frac{105}{100}\right)^{2} \\
\Longrightarrow \\
P=77175 \times \frac{20}{21} \times \frac{20}{21}=70000
\end{gathered}
$$

## Step 4

Thus, the sum is 70000 .
(2) c. 440000

## Step 1

Let the present original value of the property $=P$
The increased value of the property $=532400$
The rate of increase, $r=10 \%$

## Step 2

We know the increased value of the property is given by the formula, $A=P\left(1+\frac{r}{100}\right)^{n}$ Now, substitute the values in the formula:

$$
\begin{aligned}
& 532400=P\left(1+\frac{10}{100}\right)^{n} \\
\Longrightarrow & 532400=P\left(1+\frac{10}{100}\right)^{2} \\
\Longrightarrow & 532400=P\left(\frac{11}{10}\right)^{2} \\
\Longrightarrow & 532400=P \frac{121}{100} \\
\Longrightarrow & P=\frac{532400 \times 100}{121} \\
\Longrightarrow & n=440000
\end{aligned}
$$

## Step 3

Hence, the original value at the beginning was 440000 .
(3) 8750

## Step 1

The population grew from 5600 to 7000 in 4 years. That is a growth of 1400 on 5600 during a three-year span.
Therefore, the rate of growth for three years has been $\frac{1400}{5600}=\frac{1}{4}$

## Step 2

Now, the rate of growth during the next four years will also be the same.
Therefore, the population will grow from 7000 by $\frac{1}{4} \times 7000=1750$

## Step 3

Hence, the population four years from now will be $7000+1750=8750$.
(4)

## Step 1

Given:
Principal $(P)=80000$
$R_{1}=9 \%$
$R_{2}=11 \%$
Using the formula, $A=P\left(1+\frac{R_{1}}{100}\right)\left(1+\frac{R_{2}}{100}\right)$, we have
Amount after 2 years $=\left\{80000 \times\left(1+\frac{9}{100}\right) \times\left(1+\frac{11}{100}\right)\right\}$
$=\left(80000 \times \frac{109}{100} \times \frac{111}{100}\right)$
$=96792$

## Step 2

$\therefore$ Compound interest $=$ Amount - Principal

$$
\begin{aligned}
& =(96792-80000) \\
& =16792
\end{aligned}
$$

## Step 3

Therefore, the compound interest is 16792 .
(5) 81608

## Step 1

Since population increases by 1\% annually, we can use compound interest formula where current population can be considered as principal.

## Step 2

Current population or principal, $\mathrm{P}=80000$
Rate, $R$ by which population increases every year $=1 \%$
Time, $\mathrm{n}=2$ years

## Step 3

Population of the town after 2 years or Amount $=P\left[1+\frac{R}{100}\right]^{n}$
$=80000\left[1+\frac{1}{100}\right]^{2}$
$=80000 \times 1.0201$
$=81608$

## Step 4

Therefore, the population of the town after 2 years will be 81608.
(6) 3 years

## Step 1

Assume in $n$ complete years a sum of money (say $P$ ) put at $30 \%$ compound interest will be more than doubled.
So, Amount $=P\left(1+\frac{30}{100}\right)^{n}$

## Step 2

Now, in $n$ years, Amount is more than doubled.
So,

$$
\begin{align*}
& P\left(1+\frac{30}{100}\right)^{n}>2 P \\
\Longrightarrow & \left(1+\frac{30}{100}\right)^{n}>2 \\
\Longrightarrow & \left(\frac{13}{10}\right)^{n}>2
\end{align*}
$$

## Step 3

Now, the least value of $n$ for which equation (1) is true is 3 . Hence, in at least 3 years the sum of money will be more than doubled.

## Step 1

Interest from the start of 2005 to the start of 2010 (for 5 years) $=10000$
Interest from the start of 2005 to the start of 2015 (for 10 years) $=25000$

## Step 2

Let the principal $=x$
And annual interest rate $=r \%$
Then, $A=P\left(1+\frac{r}{100}\right)^{n}$
Amount for 5 years $=x\left(1+\frac{r}{100}\right)^{5}$
Thus, $x\left(1+\frac{r}{100}\right)^{5}=x+10000$
And amount for 10 years $=x\left(1+\frac{r}{100}\right)^{1} 0$
Thus, $x\left(1+\frac{r}{100}\right)^{1} 0=x+25000$

## Step 3

Let us take, $\left(1+\frac{r}{100}\right)^{5}=a$
Then, $x\left(1+\frac{r}{100}\right)^{5}=x a=x+10000$
Then, $x\left(1+\frac{r}{100}\right)^{1} 0=x a^{2}=x+25000$
We can rewrite equations (3) and (4) as
$x(a-1)=10000$

$$
x\left(a^{2}-1\right)=25000
$$

$\Longrightarrow x(a-1)(a+1)=25000$
$\Longrightarrow 10000 \times(a+1)=25000$
$\Longrightarrow a+1=\frac{25000}{10000}$
$\Longrightarrow a+1=\frac{5}{2}$
$\Longrightarrow a=\frac{5}{2}-1$
$\Longrightarrow a=\frac{3}{2}$

## Step 4

So, $a-1=\frac{3}{2}-1$
$\Longrightarrow a-1=\frac{1}{2}$
Now, $x(a-1)=10000$
$\Longrightarrow x \times \frac{1}{2}=10000$
$\Longrightarrow x=20000$

## Step 5

## (8) 11520

## Step 1

It is give that,
Number of workers in the factory, $\mathrm{P}=8000$
Yearly compounding rate, $\mathrm{R}=20 \%$
Time, $\mathrm{n}=2$ years

## Step 2

Number of workers after 2 years $=P\left(1+\frac{R}{100}\right)^{n} \ldots$ [Using compound interest formula]

$$
\begin{aligned}
& =8000\left(1+\frac{20}{100}\right)^{2} \\
& =8000 \times(1.2)^{2} \\
& =8000 \times 1.44 \\
& =11520
\end{aligned}
$$

## Step 3

Therefore, the number of workers in the factory after 2 years is 11520.
(9) 146503

## Step 1

## Given:

$\operatorname{Principal}(P)=512000$
Rate $(R)=8 \frac{3}{4} \%=\frac{35}{4} \%$
Time $(n)=3$ years
Using the formula, $A=P\left(1+\frac{R}{100}\right)^{n}$, we have
Amount after 3 years $=\left\{512000 \times\left(1+\frac{35}{4 \times 100}\right)\right\}^{3}$

$$
\begin{aligned}
& =\left\{512000 \times\left(\frac{435}{400}\right)^{3}\right\} \\
& =\left\{512000 \times \frac{87}{80} \times \frac{87}{80} \times \frac{87}{80}\right\} \\
& =(87 \times 87 \times 87) \\
& =658503
\end{aligned}
$$

## Step 2

$$
\begin{aligned}
\therefore \text { Compound interest } & =\text { Amount }- \text { Principal } \\
& =(658503-512000) \\
& =146503
\end{aligned}
$$

## Step 3

Therefore, the compound interest is 146503 .
(10) 11, 739

## Step 1

$$
\begin{aligned}
\text { Present population } & =10,000\left(1+\frac{7.5}{100}\right)\left(1+\frac{5}{100}\right)\left(1+\frac{4}{100}\right) \\
& =10,000 \times \frac{107.5}{100} \times \frac{105}{100} \times \frac{104}{100} \\
& =11,739
\end{aligned}
$$

## Step 2

Hence, the present population of the town is 11,739 .

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