COMPOUND INTREST

IMPORTANT FORMULAS -

1. Let Principal = P, Rate = R% per annum, Time = n years.
2. **When interest is compound Annually:**

   $$\text{Amount} = P\left(1 + \frac{R}{100}\right)^{n}$$
3. **When interest is compounded Half-yearly:**

   $$\text{Amount} = P\left[1 + \frac{(R/2)}{100}\right]^{2n}$$
4. **When interest is compounded Quarterly:**

   $$\text{Amount} = P\left[1 + \frac{(R/4)}{100}\right]^{4n}$$
5. **When interest is compounded Annually but time is in fraction, say $3\frac{2}{5}$ years.**

   $$\text{Amount} = P\left(1 + \frac{R}{100}\right)^{3} \times \left(1 + \frac{\frac{2}{5}R}{100}\right)$$
6. **When Rates are different for different years**, say R_1%, R_2%, R_3% for 1st, 2nd and 3rd year respectively.

   $$\text{Then, Amount} = P\left(1 + \frac{R_1}{100}\right)\left(1 + \frac{R_2}{100}\right)\left(1 + \frac{R_3}{100}\right).$$
7. **Present worth of Rs. *x* due *n* years hence is given by:**

   $$\text{Present Worth} = \frac{x}{\left(1 + \frac{R}{100}\right)^{n}}$$

1. A bank offers 5% compound interest calculated on half-yearly basis. A customer deposits Rs. 1600 each on 1st January and 1st July of a year. At the end of the year, the amount he would have gained by way of interest is:

   A. Rs. 120

   B. Rs. 121

   C. Rs. 122

   D. Rs. 123

   Answer: Option **B**

   Explanation:

   $$\text{Amount} = \text{Rs.}\left[1600 \times \left(1 + \frac{5}{2 \times 100}\right)^{2} + 1600 \times \left(1 + \frac{5}{2 \times 100}\right)\right]$$

$$= \text{Rs.} \left[1600 \times \frac{41}{40} \times \frac{41}{40} + 1600 \times \frac{41}{40} \right]$$

$$= \text{Rs.} \left[1600 \times \frac{41}{40}\left(\frac{41}{40} + 1\right) \right]$$

$$= \text{Rs.} \left[\frac{1600 \times 41 \times 81}{40 \times 40} \right]$$

$$= \text{Rs. } 3321.$$

$\therefore$ C.I. = Rs. (3321 - 3200) = Rs. 121

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2. The difference between simple and compound interests compounded annually on a certain sum of money for 2 years at 4% per annum is Re. 1. The sum (in Rs.) is:

A. 625

B. 630

C. 640

D. 650

Answer: Option **A**

Explanation:

Let the sum be Rs. x. Then,

$$\text{C.I.} = \left[x\left(1 + \frac{4}{100}\right)^2 - x \right] = \left(\frac{676}{625}x - x\right) = \frac{51}{625}x.$$

$$\text{S.I.} = \left(\frac{x \times 4 \times 2}{100}\right) = \frac{2x}{25}.$$

$$\therefore \frac{51x}{625} - \frac{2x}{25} = 1$$

$\Rightarrow x = 625.$

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3. There is 60% increase in an amount in 6 years at simple interest. What will be the compound interest of Rs. 12,000 after 3 years at the same rate?

A. Rs. 2160

B. Rs. 3120

C. Rs. 3972

D. Rs. 6240

E. None of these

Answer: Option **C**
Explanation:

Let P = Rs. 100. Then, S.I. Rs. 60 and T = 6 years.

$\therefore$ R = $\left(\frac{100 \times 60}{100 \times 6}\right)$ = 10% p.a.

Now, P = Rs. 12000. T = 3 years and R = 10% p.a.

$\therefore$ C.I. = Rs. $\left[12000 \times \left\{\left(1 + \frac{10}{100}\right)^3 - 1\right\}\right]$

= Rs. $\left(12000 \times \frac{331}{1000}\right)$

= 3972.

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4. What is the difference between the compound interests on Rs. 5000 for $1\frac{1}{2}$ years at 4% per annum compounded yearly and half-yearly?

A. Rs. 2.04

B. Rs. 3.06

C. Rs. 4.80

D. Rs. 8.30

Answer: Option **A**
Explanation:

C.I. when interest compounded yearly

= Rs. $\left[5000 \times \left(1 + \frac{4}{100}\right) \times \left(1 + \frac{\frac{1}{2} \times 4}{100}\right)\right]$

= Rs. $\left(5000 \times \frac{26}{25} \times \frac{51}{50}\right)$

= Rs. 5304.

= Rs. $\left[5000 \times \left(1 + \frac{2}{100}\right)^3\right]$

C.I. when interest is compounded half-yearly

$$= \text{Rs. } \left(5000 \times \frac{51}{50} \times \frac{51}{50} \times \frac{51}{50}\right)$$

$$= \text{Rs. } 5306.04$$

$\therefore$ Difference = Rs. (5306.04 - 5304) = Rs. 2.04

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5. The compound interest on Rs. 30,000 at 7% per annum is Rs. 4347. The period (in years) is:

A. 2

B. $2\frac{1}{2}$

C. 3

D. 4

Answer: Option **A**
Explanation:

Amount = Rs. (30000 + 4347) = Rs. 34347.

Let the time be n years.

Then, $30000 \left(1 + \frac{7}{100}\right)^n = 34347$

$\Rightarrow \left(\frac{107}{100}\right)^n = \frac{34347}{30000} = \frac{11449}{10000} = \left(\frac{107}{100}\right)^2$

$\therefore$ n = 2 years.

6. What will be the compound interest on a sum of Rs. 25,000 after 3 years at the rate of 12 p.c.p.a.?

A. Rs. 9000.30

B. Rs. 9720

C. Rs. 10123.20

D. Rs. 10483.20

E. None of these

Answer: Option **C**
Explanation:

$$\text{Amount} = \text{Rs. } \left[25000 \times \left(1 + \frac{12}{100}\right)^3\right]$$

$$= \text{Rs. } \left(25000 \times \frac{28}{25} \times \frac{28}{25} \times \frac{28}{25}\right)$$

= Rs. 35123.20

$\therefore$ C.I. = Rs. (35123.20 - 25000) = Rs. 10123.20

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7. At what rate of compound interest per annum will a sum of Rs. 1200 become Rs. 1348.32 in 2 years?

A. 6%

B. 6.5%

C. 7%

D. 7.5%

Answer: Option **A**
Explanation:

Let the rate be R% p.a.

Then, $1200 \times \left(1 + \frac{R}{100}\right)^2 = 1348.32$

$\Rightarrow \left(1 + \frac{R}{100}\right)^2 = \frac{134832}{120000} = \frac{11236}{10000}$

$\therefore \left(1 + \frac{R}{100}\right)^2 = \left(\frac{106}{100}\right)^2$

$\Rightarrow 1 + \frac{R}{100} = \frac{106}{100}$

$\Rightarrow R = 6\%$

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8. The least number of complete years in which a sum of money put out at 20% compound interest will be more than doubled is:

A. 3

B. 4

C. 5

D. 6

Answer: Option **B**
Explanation:

$P\left(1 + \frac{20}{100}\right)^n > 2P \quad \Rightarrow \quad \left(\frac{6}{5}\right)^n > 2.$

Now, $\left(\frac{6}{5} \times \frac{6}{5} \times \frac{6}{5} \times \frac{6}{5}\right) > 2.$

So, $n = 4$ years.

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9. Albert invested an amount of Rs. 8000 in a fixed deposit scheme for 2 years at compound interest rate 5 p.c.p.a. How much amount will Albert get on maturity of the fixed deposit?

A. Rs. 8600

B. Rs. 8620

C. Rs. 8820

D. None of these

Answer: Option **C**

Explanation:

$$\text{Amount} = \text{Rs.}\left[8000 \times \left(1 + \frac{5}{100}\right)^2\right]$$

$$= \text{Rs.}\left(8000 \times \frac{21}{20} \times \frac{21}{20}\right)$$

$$= \text{Rs. } 8820.$$

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10. The effective annual rate of interest corresponding to a nominal rate of 6% per annum payable half-yearly is:

A. 6.06%

B. 6.07%

C. 6.08%

D. 6.09%

Answer: Option **D**

Explanation:

$$\left.\begin{matrix}\text{Amount of Rs. 100 for 1 year} \\ \text{when compounded half-yearly}\end{matrix}\right\} = \text{Rs.}\left[100 \times \left(1 + \frac{3}{100}\right)^2\right] = \text{Rs. } 106.09$$

$\therefore$ Effective rate = (106.09 - 100)% = 6.09%

11. Simple interest on a certain sum of money for 3 years at 8% per annum is half the compound interest on Rs. 4000 for 2 years at 10% per annum. The sum placed on simple interest is:

A. Rs. 1550

B. Rs. 1650

C. Rs. 1750

D. Rs. 2000

Answer: Option **C**

Explanation:

C.I. $= \text{Rs.} \left[4000 \times \left(1 + \frac{10}{100} \right)^2 - 4000 \right]$

$= \text{Rs.} \left(4000 \times \frac{11}{10} \times \frac{11}{10} - 4000 \right)$

$= \text{Rs. } 840.$

$\therefore$ Sum $= \text{Rs.} \left(\frac{420 \times 100}{3 \times 8} \right) = \text{Rs. } 1750.$

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12. If the simple interest on a sum of money for 2 years at 5% per annum is Rs. 50, what is the compound interest on the same at the same rate and for the same time?

A. Rs. 51.25

B. Rs. 52

C. Rs. 54.25

D. Rs. 60

Answer: Option **A**

Explanation:

Sum $= \text{Rs.} \left(\frac{50 \times 100}{2 \times 5} \right) = \text{Rs. } 500.$

Amount $= \text{Rs.} \left[500 \times \left(1 + \frac{5}{100} \right)^2 \right]$

$= \text{Rs.} \left(500 \times \frac{21}{20} \times \frac{21}{20} \right)$

$= \text{Rs. } 551.25$

$\therefore$ C.I. = Rs. (551.25 - 500) = Rs. 51.25

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13. The difference between simple interest and compound on Rs. 1200 for one year at 10% per annum reckoned half-yearly is:

A. Rs. 2.50

B. Rs. 3

C. Rs. 3.75

D. Rs. 4

E. None of these

Answer: Option **B**
Explanation:

$$\text{S.I.} = \text{Rs } \left(\frac{1200 \times 10 \times 1}{100}\right) = \text{Rs. } 120.$$

$$\text{C.I.} = \text{Rs. } \left[1200 \times \left(1 + \frac{5}{100}\right)^2 - 1200\right] = \text{Rs. } 123.$$

$\therefore$ Difference = Rs. (123 - 120) = Rs. 3.

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14. The difference between compound interest and simple interest on an amount of Rs. 15,000 for 2 years is Rs. 96. What is the rate of interest per annum?

A. 8

B. 10

C. 12

D. Cannot be determined

E. None of these

Answer: Option **A**
Explanation:

$$\left[15000 \times \left(1 + \frac{R}{100}\right)^2 - 15000\right] - \left(\frac{15000 \times R \times 2}{100}\right) = 96$$

$$\Rightarrow 15000 \left[\left(1 + \frac{R}{100}\right)^2 - 1 - \frac{2R}{100}\right] = 96$$

$$\Rightarrow 15000 \left[\frac{(100 + R)^2 - 10000 - (200 \times R)}{10000}\right] = 96$$

$$\Rightarrow R^2 = \left(\frac{96 \times 2}{3}\right) = 64$$

$\Rightarrow$ R = 8.

$\therefore$ Rate = 8%.

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15. The compound interest on a certain sum for 2 years at 10% per annum is Rs. 525. The simple interest on the same sum for double the time at half the rate percent per annum is:

A. Rs. 400

B. Rs. 500

C. Rs. 600

D. Rs. 800

Answer: Option **B**
Explanation:

Let the sum be Rs. P.

Then, $\left[P \left(1 + \frac{10}{100} \right)^2 - P \right] = 525$

$\Rightarrow \quad P \left[\left(\frac{11}{10} \right)^2 - 1 \right] = 525$

$\Rightarrow P = \left(\frac{525 \times 100}{21} \right) = 2500.$

$\therefore$ Sum = Rs . 2500.

So, S.I. = Rs. $\left(\frac{2500 \times 5 \times 4}{100} \right)$ = Rs. 500

DATA SUFFICIENCY -1

Each of the questions given below consists of a statement and / or a question and two statements numbered I and II given below it. You have to decide whether the data provided in the statement(s) is / are sufficient to answer the given question. Read the both statements and

- Give answer (A) if the data in Statement I alone are sufficient to answer the question, while the data in Statement II alone are not sufficient to answer the question.
- Give answer (B) if the data in Statement II alone are sufficient to answer the question, while the data in Statement I alone are not sufficient to answer the question.
- Give answer (C) if the data either in Statement I or in Statement II alone are sufficient to answer the question.
- Give answer (D) if the data even in both Statements I and II together are not sufficient to answer the question.
- Give answer(E) if the data in both Statements I and II together are necessary to answer the question.

1. What is the rate of compound interest?

I. The principal was invested for 4 years.

II. The earned interest was Rs. 1491.

A. I alone sufficient while II alone not sufficient to answer

B. II alone sufficient while I alone not sufficient to answer

C. Either I or II alone sufficient to answer

D. Both I and II are not sufficient to answer

E. Both I and II are necessary to answer

Answer: Option **D**

Explanation:

Let Principal = Rs. P and Rate = R% p.a. Then,

Amount = Rs. $\left[P\left(1 + \frac{R}{100}\right)^4 \right]$

$\therefore$ C.I. = $P\left[\left(1 + \frac{R}{100}\right)^4 - 1\right]$

$\Rightarrow P\left[\left(1 + \frac{R}{100}\right)^4 - 1\right] = 1491.$

Clearly, it does not give the answer.

$\therefore$ Correct answer is (D).

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2. What will be compounded amount?

I. Rs. 200 was borrowed for 192 months at 6% compounded annually.

II. Rs. 200 was borrowed for 16 years at 6%.

A. I alone sufficient while II alone not sufficient to answer

B. II alone sufficient while I alone not sufficient to answer

C. Either I or II alone sufficient to answer

D. Both I and II are not sufficient to answer

E. Both I and II are necessary to answer

Answer: Option **C**

Explanation:

I. Amount = Rs. $\left[200 \text{ x } \left(1 + \frac{6}{100}\right)^{16} \right]$

II. Amount = Rs. $\left[200 \text{ x } \left(1 + \frac{6}{100}\right)^{16} \right]$

Thus, I as well as II gives the answer.

$\therefore$ Correct answer is (C).

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3. An amount of money was lent for 3 years. What will be the difference between the simple and the compound interest earned on it at the same rate?

I. The rate of interest was 8 p.c.p.a.

II. The total amount of simple interest was Rs. 1200.

A. I alone sufficient while II alone not sufficient to answer

B. II alone sufficient while I alone not sufficient to answer

C. Either I or II alone sufficient to answer

D. Both I and II are not sufficient to answer

E. Both I and II are necessary to answer

Answer: Option **E**
Explanation:

Given: T = 3 years.

I. gives: R = 8% p.a.
II. gives: S.I. = Rs. 1200.

Thus, P = Rs. 5000, R = 8% p.a. and T = 3 years.

∴ Difference between C.I. and S.I. may be obtained.

So, the correct answer is (E).

DATA SUFFICIENCY -2

Each of the questions given below consists of a question followed by three statements. You have to study the question and the statements and decide which of the statement(s) is/are necessary to answer the question.

1. What is the rate of interest p.c.p.a.?

I. An amount doubles itself in 5 years on simple interest.

II. Difference between the compound interest and the simple interest earned on a certain amount in 2 years is Rs. 400.

III. Simple interest earned per annum is Rs. 2000.

A. I only

B. II and III only

C. All I, II and III

D. Any two of the three

E. I only or II and III only

Answer: Option **E**
Explanation:

I. $\frac{P \times R \times 5}{100} = P \Rightarrow R = 20.$

II. $P\left(1 + \frac{R}{100}\right)^2 - P - \frac{P \times R \times 2}{100} = 400 \Rightarrow PR^2 = 4000000.$

III. $\frac{P \times R \times 1}{100} = 2000 \Rightarrow PR = 200000.$

$\therefore \frac{PR^2}{PR} = \frac{4000000}{200000} \Rightarrow R = 20.$

Thus I only or (II and III) give answer.

$\therefore$ Correct answer is (E).

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2. What will be the compound interest earned on an amount of Rs. 5000 in 2 years?

I. The simple interest on the same amount at the same rate of interest in 5 years is Rs. 2000.

II. The compound interest and the simple interest earned in one year is the same.

III. The amount becomed more than double on compound interest in 10 years.

A. I only

B. I and II only

C. II and III only

D. I and III only

E. None of these

Answer: Option **A**
Explanation:

P = Rs. 5000 & T = 2 years.

I. S.I. on Rs. 5000 in 5 years is Rs. 2000.

$\frac{5000 \times R \times 5}{100} = 2000 \Rightarrow R = 8.$

Thus I only gives the answer.

$\therefore$ Correct answer is (A).

DATA SUFFICIENCY -3

In each of the following questions, a question is asked and is followed by three statements. While answering the question, you may or may not require the data provided in all the statements. You have to read the question and the three statements and then decide whether the question can be answered with any one or two of the statements or all the three statements are required to answer the question. The answer number bearing the statements, which can be dispensed with, if any, while answering the question is your answer.

1. Mr. Gupta borrowed a sum of money on compound interest. What will be the amount to be repaid if he is repaying the entire amount at the end of 2 years?

I. The rate of interest is 5 p.c.p.a.

II. Simple interest fetched on the same amount in one year is Rs. 600.

III. The amount borrowed is 10 times the simple interest in 2 years.

A. I only

B. III only

C. I or II only

D. II and Either I or III only

E. All I, II and III are required

Answer: Option **D**

Explanation:

I. gives, Rate = 5% p.a.

II. gives, S.I. for 1 year = Rs. 600.

III. gives, sum = 10 x (S.I. for 2 years).

Now I, and II give the sum.

For this sum, C.I. and hence amount can be obtained.

Thus, III is redundant.

Again, II gives S.I. for 2 years = Rs. (600 x 2) = Rs. 1200.

Now, from III, Sum = Rs. (10 x 1200) = Rs . 12000.

Thus, Rate = $\frac{100 \times 1200}{2 \times 12000}$ = 5% p.a.

Thus, C.I. for 2 years and therefore, amount can be obtained.

Thus, I is redundant.

Hence, I or III redundant.

2. What is the compound interest earned at the end of 3 years?

I. Simple interest earned on that amount at the same rate and for the same period is Rs. 4500.

II. The rate of interest is 10 p.c.p.a.

III. Compound interest for 3 years is more than the simple interest for that period by Rs. 465.

A. I and II only

B. II and III only

C. I and III only

D. I and Either II or III only

E. Any two of the three

Answer: Option **D**

Explanation:

I. gives, S.I for 3 years = Rs. 4500.
II. gives, Rate = 10% p.a.
III. gives, (C.I.) - (S.I.) = Rs. 465.

Clearly, using I and III we get C.I. = Rs. (465 + 4500).

Thus, II is redundant.

Also, from I and II, we get sum = $\left(\frac{100 \times 4500}{10 \times 3}\right)$ = 15000.

Now C.I. on Rs. 15000 at 10% p.a. for 3 years may be obtained.

Thus, III is redundant.

$\therefore$ Either II or III is redundant