

INTERESTS

A DEFINITIONS

A.1 FINDING THE INTEREST

Ex 1: Louis lends Hugo 100 dollars. After one year, Hugo repays Louis 110 dollars.
Find the interest paid.

10 dollars

Answer: The interest paid is the difference between the amount repaid and the original amount lent:

$$\begin{aligned}\text{Interest} &= \text{Amount repaid} - \text{Original amount} \\ &= 110 - 100 \\ &= 10 \text{ dollars}\end{aligned}$$

Ex 2: Maria borrows 200 dollars from John. After one year, Maria repays John 230 dollars.
Find the interest paid.

30 dollars

Answer: The interest paid is the difference between the amount repaid and the original amount lent:

$$\begin{aligned}\text{Interest} &= \text{Amount repaid} - \text{Original amount} \\ &= 230 - 200 \\ &= 30 \text{ dollars}\end{aligned}$$

Ex 3: Jack lends Sarah 500 dollars. After one year, Sarah repays Jack 525 dollars.
Find the interest paid.

25 dollars

Answer: The interest paid is the difference between the amount repaid and the original amount lent:

$$\begin{aligned}\text{Interest} &= \text{Amount repaid} - \text{Original amount} \\ &= 525 - 500 \\ &= 25 \text{ dollars}\end{aligned}$$

Ex 4: A bank lends 1 000 dollars to a customer. After one year, the customer repays the bank 1 080 dollars.
Find the interest paid.

80 dollars

Answer: The interest paid is the difference between the amount repaid and the original amount lent:

$$\begin{aligned}\text{Interest} &= \text{Amount repaid} - \text{Original amount} \\ &= 1\,080 - 1\,000 \\ &= 80 \text{ dollars}\end{aligned}$$

A.2 FINDING THE TOTAL AMOUNT

Ex 5: A customer borrows 2 500 dollars from a bank, with 150 dollars of interest.
Find the total amount the customer needs to repay the bank.

2650 dollars

Answer: The total amount to be repaid is the sum of the original amount borrowed (the principal) and the interest:

$$\begin{aligned}\text{Amount to repay} &= \text{Principal} + \text{Interest} \\ &= 2\,500 + 150 \\ &= 2\,650 \text{ dollars}\end{aligned}$$

Ex 6: Maria borrows 300 dollars from John with 30 dollars of interest.
Find the amount Maria needs to repay.

330 dollars

Answer: The total amount to be repaid is the sum of the original amount borrowed (the principal) and the interest:

$$\begin{aligned}\text{Amount to repay} &= \text{Principal} + \text{Interest} \\ &= 300 + 30 \\ &= 330 \text{ dollars}\end{aligned}$$

Ex 7: Jack lends Sarah 500 dollars with 50 dollars of interest.
Find the total amount Sarah needs to repay Jack.

550 dollars

Answer: The total amount to be repaid is the sum of the original amount borrowed (the principal) and the interest:

$$\begin{aligned}\text{Amount to repay} &= \text{Principal} + \text{Interest} \\ &= 500 + 50 \\ &= 550 \text{ dollars}\end{aligned}$$

Ex 8: A bank lends 1 000 dollars to a customer with 80 dollars of interest.
Find the total amount the customer needs to repay the bank.

1080 dollars

Answer: The total amount to be repaid is the sum of the original amount borrowed (the principal) and the interest:

$$\begin{aligned}\text{Amount to repay} &= \text{Principal} + \text{Interest} \\ &= 1\,000 + 80 \\ &= 1\,080 \text{ dollars}\end{aligned}$$

A.3 FINDING THE PRINCIPAL

Ex 9: Emma repaid 330 dollars in total, including 30 dollars of interest.
Find the original amount (principal) that Emma borrowed.

300 dollars

Answer: The principal is the difference between the total amount repaid and the interest paid:

$$\begin{aligned}\text{Principal} &= \text{Amount repaid} - \text{Interest} \\ &= 330 - 30 \\ &= 300 \text{ dollars}\end{aligned}$$

Ex 10: Lucas repaid 550 dollars in total, including 50 dollars of interest.

Find the original amount (principal) that Lucas borrowed.

$$\boxed{500} \text{ dollars}$$

Answer: The principal is the difference between the total amount repaid and the interest paid:

$$\begin{aligned}\text{Principal} &= \text{Amount repaid} - \text{Interest} \\ &= 550 - 50 \\ &= 500 \text{ dollars}\end{aligned}$$

Ex 11: Sophia repaid 1,080 dollars in total, including 80 dollars of interest.

Find the original amount (principal) that Sophia borrowed.

$$\boxed{1000} \text{ dollars}$$

Answer: The principal is the difference between the total amount repaid and the interest paid:

$$\begin{aligned}\text{Principal} &= \text{Amount repaid} - \text{Interest} \\ &= 1,080 - 80 \\ &= 1,000 \text{ dollars}\end{aligned}$$

Ex 12: Mia repaid 750 dollars in total, including 150 dollars of interest.

Find the original amount (principal) that Mia borrowed.


$$\boxed{600} \text{ dollars}$$

Answer: The principal is the difference between the total amount repaid and the interest paid:

$$\begin{aligned}\text{Principal} &= \text{Amount repaid} - \text{Interest} \\ &= 750 - 150 \\ &= 600 \text{ dollars}\end{aligned}$$

B SIMPLE INTEREST


B.1 FINDING THE INTEREST

Ex 13:  Find the simple interest on a principal of \$500 at a rate of 3% per year over 5 years.

$$\boxed{75} \text{ dollars}$$

Answer:


$$\begin{aligned}\text{Interest} &= \text{Number of years} \times \text{Percentage of the principal} \\ &= 5 \times 3\% \text{ of } 500 \\ &= 5 \times \frac{3}{100} \times 500 \\ &= 75 \text{ dollars}\end{aligned}$$

Ex 14:  Find the simple interest on a principal of \$1 000 at a rate of 4% per year over 3 years.

$$\boxed{120} \text{ dollars}$$

Answer:


$$\begin{aligned}\text{Interest} &= \text{Number of years} \times \text{Percentage of the principal} \\ &= 3 \times 4\% \text{ of } 1\,000 \\ &= 3 \times \frac{4}{100} \times 1\,000 \\ &= 120 \text{ dollars}\end{aligned}$$

Ex 15:  Find the simple interest on a principal of \$750 at a rate of 5% per year over 2 years.

$$\boxed{75} \text{ dollars}$$

Answer:

$$\begin{aligned}\text{Interest} &= \text{Number of years} \times \text{Percentage of the principal} \\ &= 2 \times 5\% \text{ of } 750 \\ &= 2 \times \frac{5}{100} \times 750 \\ &= 75 \text{ dollars}\end{aligned}$$


Ex 16:  Find the simple interest on a principal of \$1 200 at a rate of 6% per year over 4 years.

$$\boxed{288} \text{ dollars}$$

Answer:

$$\begin{aligned}\text{Interest} &= \text{Number of years} \times \text{Percentage of the principal} \\ &= 4 \times 6\% \text{ of } 1\,200 \\ &= 4 \times \frac{6}{100} \times 1\,200 \\ &= 288 \text{ dollars}\end{aligned}$$

B.2 FINDING THE INTEREST OVER MIXED TIME PERIODS

Ex 17:  Find the simple interest on a principal of \$600 at a rate of 4% per year over 18 months.

$$\boxed{36} \text{ dollars}$$


Answer:

- Convert the time from months to years:

$$\begin{aligned}18 \text{ months} &= \frac{18}{12} \text{ years} \\ &= 1.5 \text{ years}\end{aligned}$$

- Calculate the interest:

$$\begin{aligned}\text{Interest} &= \text{Number of years} \times \text{Percentage of the principal} \\ &= 1.5 \times 4\% \text{ of } 600 \\ &= 1.5 \times \frac{4}{100} \times 600 \\ &= 36 \text{ dollars}\end{aligned}$$

Ex 18:  Find the simple interest on a principal of \$700 at a rate of 5% per year over 180 days.

17.26 dollars (round at two decimal place)


Answer:

- Convert the time from days to years:

$$\begin{aligned} 180 \text{ days} &= \frac{180}{365} \text{ years} \\ &\approx 0.493 \text{ years} \end{aligned}$$

- Calculate the interest:

$$\begin{aligned} \text{Interest} &= \text{Number of years} \times \text{Percentage of the principal} \\ &= 0.493 \times 5\% \text{ of } 700 \\ &= 0.493 \times \frac{5}{100} \times 700 \\ &= 17.26 \text{ dollars} \end{aligned}$$

Ex 19:  Find the simple interest on a principal of \$800 at a rate of 4% per year over 9 months.

24 dollars


Answer:

- Convert the time from months to years:

$$\begin{aligned} 9 \text{ months} &= \frac{9}{12} \text{ years} \\ &= 0.75 \text{ years} \end{aligned}$$

- Calculate the interest:

$$\begin{aligned} \text{Interest} &= \text{Number of years} \times \text{Percentage of the principal} \\ &= 0.75 \times 4\% \text{ of } 800 \\ &= 0.75 \times \frac{4}{100} \times 800 \\ &= 24 \text{ dollars} \end{aligned}$$

Ex 20:  Find the simple interest on a principal of \$1 200 at a rate of 4% per year over 2 years and 6 months.

120 dollars

Answer:


- Convert the time from years and months to just years:

$$\begin{aligned} 2 \text{ years } 6 \text{ months} &= 2 + \frac{6}{12} \text{ years} \\ &= 2 + 0.5 \text{ years} \\ &= 2.5 \text{ years} \end{aligned}$$

- Calculate the interest:

$$\begin{aligned} \text{Interest} &= \text{Number of years} \times \text{Percentage of the principal} \\ &= 2.5 \times 4\% \text{ of } 1\,200 \\ &= 2.5 \times \frac{4}{100} \times 1\,200 \\ &= 120 \text{ dollars} \end{aligned}$$

B.3 FINDING THE TOTAL AMOUNT

Ex 21:  Jack lends Sarah 500 dollars with simple interest over 3 years at a rate of 3% per year. Find the total amount Sarah needs to repay Jack.

545 dollars

Answer:


- The total amount to be repaid is the sum of the original amount borrowed (the principal) and the interest.

- Calculate the interest

$$\begin{aligned} \text{Interest} &= \text{Number of years} \times \text{Percentage of the principal} \\ &= 3 \times \frac{3}{100} \times 500 \\ &= 45 \text{ dollars} \end{aligned}$$

- Calculate the total amount to repay:

$$\begin{aligned} \text{Amount to repay} &= \text{Principal} + \text{Interest} \\ &= 500 + 45 \\ &= 545 \text{ dollars} \end{aligned}$$

Ex 22:  Emma borrows 600 dollars from a bank with simple interest over 4 years at a rate of 2.5% per year. Find the total amount Emma needs to repay the bank.

660 dollars

Answer:


- The total amount to be repaid is the sum of the original amount borrowed (the principal) and the interest.

- Calculate the interest

$$\begin{aligned} \text{Interest} &= \text{Number of years} \times \text{Percentage of the principal} \\ &= 4 \times \frac{2.5}{100} \times 600 \\ &= 60 \text{ dollars} \end{aligned}$$

- Calculate the total amount to repay:

$$\begin{aligned} \text{Amount to repay} &= \text{Principal} + \text{Interest} \\ &= 600 + 60 \\ &= 660 \text{ dollars} \end{aligned}$$

Ex 23:  Michael lends 800 dollars to a friend with simple interest over 2 years at a rate of 4% per year. Find the total amount the friend needs to repay Michael.

864 dollars

Answer:


- The total amount to be repaid is the sum of the original amount borrowed (the principal) and the interest.

- Calculate the interest

$$\begin{aligned}\text{Interest} &= \text{Number of years} \times \text{Percentage of the principal} \\ &= 2 \times \frac{4}{100} \times 800 \\ &= 64 \text{ dollars}\end{aligned}$$

- Calculate the total amount to repay:

$$\begin{aligned}\text{Amount to repay} &= \text{Principal} + \text{Interest} \\ &= 800 + 64 \\ &= 864 \text{ dollars}\end{aligned}$$

Ex 24:  Sophia borrows 1 200 dollars with simple interest over 5 years at a rate of 2.5% per year. Find the total amount Sophia needs to repay.

1350 dollars

Answer:

- The total amount to be repaid is the sum of the original amount borrowed (the principal) and the interest.
- Calculate the interest


$$\begin{aligned}\text{Interest} &= \text{Number of years} \times \text{Percentage of the principal} \\ &= 5 \times \frac{2.5}{100} \times 1\,200 \\ &= 150 \text{ dollars}\end{aligned}$$

- Calculate the total amount to repay:

$$\begin{aligned}\text{Amount to repay} &= \text{Principal} + \text{Interest} \\ &= 1\,200 + 150 \\ &= 1\,350 \text{ dollars}\end{aligned}$$

C COMPOUND INTEREST

C.1 FINDING THE TOTAL AMOUNT USING A TABLE

Ex 25:  \$1000 is placed in an account that earns 10% interest per annum (p.a.), and the interest is allowed to compound over three years. This means the account is earning 10% p.a. in compound interest. Fill the compound interest table .

Year	Amount	Compound interest
0	\$1000	10% of \$1000 = \$100
1	\$1000 + \$100 = \$1100	10% of \$1100 = \$110
2	\$ 1210	121
3	\$ 1331	


Find the amount at 3 years.

1331 dollars

Answer:

Year	Amount	Compound interest
0	\$1000	10% of \$1000 = \$100
1	\$1000 + \$100 = \$1100	10% of \$1100 = \$110
2	\$1100 + \$110 = \$1210	10% of \$1210 = \$121
3	\$1210 + \$121 = \$1331	

The amount at 3 years is 1331 dollars.

Ex 26:  \$3000 is placed in an account that earns 20% interest per annum (p.a.), and the interest is allowed to compound over three years. This means the account is earning 20% p.a. in compound interest. Fill the compound interest table.

Year	Amount	Compound interest
0	\$3 000	20% of \$3 000 = \$600
1	\$3 000 + \$600 = \$3 600	20% of \$3 600 = \$720
2	\$ 4320	864
3	\$ 5184	


Find the amount at 3 years.

5184 dollars

Answer:

Year	Amount	Compound interest
0	\$3 000	20% de \$3 000 = \$600
1	\$3 000 + \$600 = \$3 600	20% de \$3 600 = \$720
2	\$3 600 + \$720 = \$4 320	20% de \$4 320 = \$864
3	\$4 320 + \$864 = \$5 184	

The amount at 3 years is 5 184 dollars.

Ex 27:  \$3000 is placed in an account that earns 20% interest per annum (p.a.), and the interest is allowed to compound over three years. This means the account is earning 20% p.a. in compound interest. Fill the compound interest table.

Year	Amount	Compound interest
0	\$3 000	600
1	\$ 3600	720
2	\$ 4320	

Find the amount after 2 years.


4320 dollars

Answer:

Year	Amount	Compound interest
0	\$3 000	20% of \$3 000 = \$600
1	\$3 000 + \$600 = \$3 600	20% of \$3 600 = \$720
2	\$3 600 + \$720 = \$4 320	20% of \$4 320 = \$864

The amount at 3 years is 4320 dollars.

C.2 FINDING THE TOTAL AMOUNT

Ex 28:  Find the final amount on a principal of \$10 000 at a rate of 10% per year over 3 years compounded yearly.

13310 dollars

Answer:

• **Method 1: Amount over year**


- Year 0: Initial amount = \$10 000
- Year 1: \$10 000 + 10% of 10 000 = \$11 000
- Year 2: \$11 000 + 10% of 11 000 = \$12 100
- Year 3: \$12 100 + 10% of 12 100 = \$13 310

So, the final amount after 3 years is \$13 310.

• **Method 2: Using the compound interest Formula**

$$\begin{aligned}
 A &= (1 + r)^t P \\
 &= (1 + 0.10)^3 10\,000 \quad (\text{substituting the values}) \\
 &= 13\,310
 \end{aligned}$$

Thus, the final amount after 3 years is \$13 310.

Ex 29:  Find the final amount on a principal of \$200 000 at a rate of 5% per year over 3 years compounded yearly.

231525 dollars

Answer:

• **Method 1: Amount over year**


- Year 0: Initial amount = \$200 000
- Year 1: \$200 000 + 5% of 200 000 = \$210 000
- Year 2: \$210 000 + 5% of 210 000 = \$220 500
- Year 3: \$220 500 + 5% of 220 500 = \$231 525

So, the final amount after 3 years is \$231 525.

• **Method 2: Using the compound interest Formula**

$$\begin{aligned}
 A &= (1 + r)^t P \\
 &= (1 + 0.05)^3 200\,000 \quad (\text{substituting the values}) \\
 &= 231\,525
 \end{aligned}$$

Thus, the final amount after 3 years is \$231 525.

Ex 30:  Find the final amount on a principal of \$5 000 at a rate of 8% per year over 2 years compounded yearly.

5832 dollars

Answer:

• **Method 1: Amount over year**


- Year 0: Initial amount = \$5 000
- Year 1: \$5 000 + 8% of 5 000 = \$5 400
- Year 2: \$5 400 + 8% of 5 400 = \$5 832

So, the final amount after 2 years is \$5 832.

• **Method 2: Using the Compound Interest Formula**

$$\begin{aligned}
 A &= (1 + r)^t P \\
 &= (1 + 0.08)^2 5\,000 \quad (\text{substituting the values}) \\
 &= 5\,832
 \end{aligned}$$

Thus, the final amount after 2 years is \$5 832.

Ex 31:  Find the final amount on a principal of \$5 000 at a rate of 8% per year over 20 years compounded yearly (round at 2 decimal places).


23304.79 dollars

Answer: Using the compound interest formula,

$$\begin{aligned}
 A &= (1 + r)^t P \\
 &= (1 + 0.08)^{20} 5\,000 \quad (\text{substituting the values}) \\
 &\approx 23\,304.79 \text{ dollars}
 \end{aligned}$$

Thus, the final amount after 20 years is \$23 304.79.

C.3 FINDING THE BEST OPTION OF INVESTMENT

Ex 32:  You have \$8000 to invest for 5 years and there are 2 possible options you have been offered:

- Option 1: Invest at 9% p.a. simple interest.
- Option 2: Invest at 8% p.a. compound interest.
- Calculate the amount accumulated at the end of the 3 years for option 1 (round to the nearest integer)

11600 dollars

- Calculate the amount accumulated at the end of the 3 years for option 2 (round to the nearest integer)

11755 dollars

- Decide which option to take.

Option 2

Answer:

- **Option 1: Simple Interest** For option 1, we substitute the values in the formula for simple interest:

$$\begin{aligned}
 A &= (1 + t \times r) \times P \\
 &= (1 + 5 \times 0.09) \times 8\,000 \\
 &= 11\,600 \text{ dollars}
 \end{aligned}$$

Thus, the amount accumulated for option 1 after 5 years is \$11 600.

- **Option 2: Compound Interest**

For option 2, we substitute the value in the formula for compound interest

$$\begin{aligned}
 A &= (1 + r)^t P \\
 &= (1 + 0.08)^5 \times 8\,000 \\
 &\approx 11\,755 \text{ dollars}
 \end{aligned}$$

Thus, the amount accumulated for option 2 after 5 years is \$11 754.

- **Conclusion**

Comparing the two options, we see that:

- Option 1 (simple interest) gives \$11 600,

- Option 2 (compound interest) gives \$11 755.

Since option 2 gives a higher final amount, it would be better to choose option 2 with compound interest.



Ex 33: You have \$20 000 to invest for 5 years and there are 2 possible options you have been offered:

- Option 1: Invest at 7% p.a. simple interest.
- Option 2: Invest at 6% p.a. compound interest.
- Calculate the amount accumulated at the end of 5 years for option 1 (round to the nearest integer):

27000 dollars

- Calculate the amount accumulated at the end of 5 years for option 2 (round to the nearest integer):

26764 dollars

- Decide which option to take.

Option 1

Answer:

- **Option 1: Simple Interest**

For option 1, we substitute the values in the formula for simple interest:

$$\begin{aligned} A &= (1 + t \times r) \times P \\ &= (1 + 5 \times 0.07) \times 20\,000 \\ &= (1 + 0.35) \times 20\,000 \\ &= 1.35 \times 20\,000 \\ &= 27\,000 \text{ dollars} \end{aligned}$$

Thus, the amount accumulated for option 1 after 5 years is \$27 000.

- **Option 2: Compound Interest**

For option 2, we substitute the values in the formula for compound interest:

$$\begin{aligned} A &= (1 + r)^t \times P \\ &= (1 + 0.06)^5 \times 20\,000 \\ &= (1.06)^5 \times 20\,000 \\ &\approx 26\,764 \text{ dollars} \end{aligned}$$

Thus, the amount accumulated for option 2 after 5 years is \$26 744.

- **Conclusion**

Comparing the two options:

- Option 1 (simple interest) gives \$27 000,
- Option 2 (compound interest) gives \$26 764.

Since option 1 gives a higher final amount, it is better to choose option 1 with simple interest.



Ex 34: You have \$50 000 to invest for 30 years and there are 2 possible options you have been offered:

- Option 1: Invest at 10% p.a. simple interest.
- Option 2: Invest at 9% p.a. compound interest.
- Calculate the amount accumulated at the end of the 30 years for option 1 (round to the nearest integer):

200000 dollars

- Calculate the amount accumulated at the end of the 30 years for option 2 (round to the nearest integer):

663384 dollars

- Decide which option to take.

Option 2

Answer:

- **Option 1: Simple Interest**

For option 1, we substitute the values in the formula for simple interest:

$$\begin{aligned} A &= (1 + t \times r) \times P \\ &= (1 + 30 \times 0.10) \times 50\,000 \\ &= (1 + 3.0) \times 50\,000 \\ &= 4.0 \times 50\,000 \\ &= 200\,000 \text{ dollars} \end{aligned}$$

Thus, the amount accumulated for option 1 after 30 years is \$200 000.

- **Option 2: Compound Interest**

For option 2, we substitute the values in the formula for compound interest:

$$\begin{aligned} A &= (1 + r)^t \times P \\ &= (1 + 0.09)^{30} \times 50\,000 \\ &= (1.09)^{30} \times 50\,000 \\ &\approx 663\,384 \text{ dollars} \end{aligned}$$

Thus, the amount accumulated for option 2 after 30 years is \$663 384.

- **Conclusion**

Comparing the two options:

- Option 1 (simple interest) gives \$200 000,
- Option 2 (compound interest) gives \$663 384.

Since option 2 gives a much higher final amount, it is better to choose option 2 with compound interest.