education equals

Topic: Simple and Compound Interest

Time: 45 mins Marks: /45 marks

Calculator Assumed

Question One: [2, 2, 2, 2 : 8 marks]

a) Calculate the interest payable on a loan of $2,100, borrowed for 3 years at 2.5% simple interest.

b) After 5 years, an investment of $3,180 has increased to $4,000. If it was invested in a simple interest account, calculate the rate of interest.

c) After one and a half years the amount of interest on a simple interest investment is $57. If the rate of interest was 3.9%, what was the principal?

d) What is the total amount payable on a loan of $4,198 borrowed for 5 months at 2.8% simple interest?

Question Two: [8 marks]

Marco wishes to invest $1,200 for 8 years. The following investment opportunities are available:

1. Simple interest at 14.5% p.a.
2. Compound interest at 8.9% p.a. compounding annually.
3. Compound interest at 12.2% p.a. compounding monthly.

Which investment plan should he choose to maximize the interest earned? Show full working to justify your answer.

Question Three [8 marks]

Hazel has $7,900 invested in an account which calculates the interest by using the following breakdown.

The first $1,000 receives a flat simple interest rate of 5.4% p.a.

The next $2,000 receives a compound interest rate of 5.4% p.a. compounding annually.

The next $4,000 receives a compound interest rate of 5.4% p.a. compounding bi-annually.

The remainder of the investment receives a compound interest rate of 5.4% p.a. compounding monthly.

Calculate the interest payable to Hazel after she invests in this account for 18 months.

Question Four: [7 marks]

Justine borrows $1,000 from a loan shark where interest is calculated at 12.5% p.a. compounding monthly. However every month the interest rate increased by 0.5% p.a.

If Justine borrows the money for 3 months, how much interest does she owe after 3 months?

Question Five: [2, 2: 4 marks]

If we assume that the average annual rate of inflation were to remain steady at 4.5%, and has remained at this rate for several years leading up to now, how much would an item currently valued at $50, be worth

a) in 7 years time?

b) two years ago?

Question Six: [5 marks]

The Smith family have a $300,000 mortgage. This is borrowed at 5.9% p.a. compounded monthly for 25 years. The value of the house rises by 2.5% each year. If none of the borrowed amount, nor the interest is paid off the mortgage in 5 years, compare the size of the mortgage to the value of the house if the house was originally bought for $400,000.

Question Seven: [5 marks]

A particular commodity originally costs $95/kg at the start of 2005. For a solid 5 year period the price of the commodity appreciates by 2.1% p.a. at which point there is an oversupply of the commodity and then the price begins to depreciate at a steady 5.9% p.a.

At the beginning of which year will the price first be below $95/kg?

education equals

Simple and Compound Interest
SOLUTIONS
Time: 45 mins Marks: /45 marks

Calculator Assumed

Question One: [2, 2, 2, 2 : 8 marks]

a) Calculate the interest payable on a loan of $2,100, borrowed for 3 years at 2.5% simple interest.

$$\frac{2100 \times 3 \times 2.5}{100} = \$157.50$$

b) After 5 years, an investment of $3,180 has increased to $4,000. If it was invested in a simple interest account, calculate the rate of interest.

$$820 = \frac{3180 \times R \times 5}{100}$$

$$R = 5.16\% \text{ p. a.}$$

c) After one and a half years the amount of interest on a simple interest investment is $57. If the rate of interest was 3.9%, what was the principal?

$$57 = \frac{P \times 3.9 \times 1.5}{100}$$

$$P = \$974.36$$

d) What is the total amount payable on a loan of $4,198 borrowed for 5 months at 2.8% simple interest?

$$\frac{4198 \times 2.8 \times \frac{5}{12}}{100} = \$489.77$$

Question Two: [8 marks]

Marco wishes to invest $1,200 for 8 years. The following investment opportunities are available:

1. Simple interest at 14.5% p.a.
2. Compound interest at 8.9% p.a. compounding annually.
3. Compound interest at 12.2% p.a. compounding monthly.

Which investment plan should he choose to maximize the interest earned? Show full working to justify your answer.

1. $\frac{1200 \times 8 \times 14.5}{100} = \$1392$ Interest

2. $1200\left(1 + \frac{8.9}{100}\right)^{8} - 1200 = \$1173.58$

3. $1200\left(1 + \frac{12.2}{12 \times 100}\right)^{12\times8} - 1200 = \$1968.93$

Plan 3 is the best

Question Three [8 marks]

Hazel has $7,900 invested in an account which calculates the interest by using the following breakdown.

The first $1,000 receives a flat simple interest rate of 5.4% p.a.

The next $2,000 receives a compound interest rate of 5.4% p.a. compounding annually.

The next $4,000 receives a compound interest rate of 5.4% p.a. compounding bi-annually.

The remainder of the investment receives a compound interest rate of 5.4% p.a. compounding monthly.

Calculate the interest payable to Hazel after she invests in this account for 18 months.

$$\frac{1000 \times 5.4 \times 1.5}{100} = 81$$ ✓

$$2000\left(1 + \frac{5.4}{100}\right)^{1.5} - 2000 = 164.17$$ ✓✓

$$4000\left(1 + \frac{5.4}{2 \times 100}\right)^{2 \times 1.5} - 4000 = 332.83$$ ✓✓

$$900\left(1 + \frac{5.4}{12 \times 100}\right)^{12 \times 1.5} - 900 = 75.76$$ ✓✓

Total interest = $653.76 ✓

Question Four: [7 marks]

Justine borrows $1,000 from a loan shark where interest is calculated at 12.5% p.a. compounding monthly. However every month the interest rate increased by 0.5% p.a.

If Justine borrows the money for 3 months, how much interest does she owe after 3 months?

$$\frac{1000 \times \frac{12.5}{12}}{100} = 10.42$$

$$\frac{1010.42 \times \frac{13}{12}}{100} = 10.95$$

$$\frac{1021.37 \times \frac{13.5}{12}}{100} = 11.49$$

Total interest owing = $32.86

Question Five: [2, 2: 4 marks]

If we assume that the average annual rate of inflation were to remain steady at 4.5%, and has remained at this rate for several years leading up to now, how much would an item currently valued at $50, be worth

a) in 7 years time?

$50(1.045)^7 = \$68.04$ ✓ ✓

b) two years ago?

$x(1.045)^2 = \$50$ ✓

$x = \$45.79$ ✓

Question Six: [5 marks]

The Smith family have a $300,000 mortgage. This is borrowed at 5.9% p.a. compounded monthly for 25 years. The value of the house rises by 2.5% each year. If none of the borrowed amount, nor the interest is paid off the mortgage in 5 years, compare the size of the mortgage to the value of the house if the house was originally bought for $400,000.

$300\,000\left(1+\frac{5.9}{12\times 100}\right)^{60} = \$402\,646.75$ ✓ ✓

$400\,000(1.025)^5 = \$452\,563.29$ ✓ ✓

The mortgage is $49 916.54 less than the value of the house. ✓

Question Seven: [5 marks]

A particular commodity originally costs \$95/kg at the start of 2005. For a solid 5 year period the price of the commodity appreciates by 2.1% p.a. at which point there is an oversupply of the commodity and then the price begins to depreciate at a steady 5.9% p.a.

At the beginning of which year will the price first be below \$95/kg?

Beginning of 2010: $95(1.021)^5 = \$105.40/kg$ ✓ ✓

$105.40(0.941)^x = \$95$

$105.40(0.941)^1 = \$99.18$ (2011) ✓

$105.40(0.941)^2 = \$93.3$ (2012) ✓

∴ At the begining of 2012 ✓