Name: Key

Compound Interest /40

[15]

1. Complete the following chart:

Principal	Rate/a	Time	Compounded	Formula (①, ①)	Amount (①)	Interest (①)
$1200	12%	5 a	Semi-annually	$A = 1200\left(1+\frac{0.12}{2}\right)^{10}$	$2149.02	$949.02
$480	6%	3 a	Quarterly	$A = 480\left(1+\frac{0.06}{4}\right)^{12}$	$573.90	$93.90
$10000	8%	12 a	Annually	$A = 10000\left(1+\frac{0.08}{1}\right)^{12}$	$25 191.70	$15 191.70
$5600	$7\frac{1}{4}$%	10 a	Semi-annually	$A = 5600\left(1+\frac{0.0725}{2}\right)^{20}$	$11415.09	$5815.08
$80	$10\frac{1}{2}$%	20 a	Monthly	$A = 80\left(1+\frac{0.105}{12}\right)^{240}$	$647.35	$567.35
$1 200 000	5%	7 a	Quarterly	$A = 1200000\left(1+\frac{0.05}{4}\right)^{28}$	$1699190.76	$499 190.76

[18]

2. Examine how varying interest rates and compounding intervals affects the following investment.

Principal	Rate/a	Time	Compounded	Formula (①, ①)	Amount (①)	Interest (①)
$12 000	8%	15 a	Annually	$A = 12000\left(1+\frac{0.08}{1}\right)^{15}$	$38 066.03	$26 066.03
$12 000	8%	15 a	Semi-Annually	$A = 12000\left(1+\frac{0.08}{2}\right)^{30}$	$38 920.77	$26 920.77
$12 000	8%	15 a	Quarterly	$A = 12000\left(1+\frac{0.08}{4}\right)^{60}$	$39 372.37	$27 372.37
$12 000	8%	15 a	Monthly	$A = 12000\left(1+\frac{0.08}{12}\right)^{180}$	$39 683.06	$27683.06
$12 000	8%	15 a	Daily	$A = 12000\left(1+\frac{0.08}{365}\right)^{5475}$	$39836.16	$27836.16
$12 000	8%	15 a	Simple Interest	$I = 12000(0.08)(15)$	$26 400	$14 400

[7]

3. Which of the following investments would be worth the most money after 20 years?

$5000 at 8%/a compounded semi-annually	$7000 at 6%/a compounded daily	$17000 at 2%/a compounded monthly
$A = 5000\left(1+\frac{0.08}{2}\right)^{40}$ $= \$24\,005.10$	$A = 7000\left(1+\frac{0.06}{365}\right)^{7300}$ $= \$23\,238.53$	$A = 17000\left(1+\frac{0.02}{12}\right)^{240}$ $= \$25\,352.58$

the RULE of 72

ACTIVITY 3.5
THE RULE OF 72

There is a quick way to estimate the time it takes for an investment compounded annually to double in value. This method is called the **Rule of 72.**

Rule of 72: a quick method of estimating the time it takes for an investment to double in value

Rof 72 = 72 / Rate

Doubling Time

% 0

To calculate the approximate length of time in years it takes for an investment to double, divide 72 by the annual interest rate expressed as a percentage. If you wanted to know approximately how long it would take an investment with an interest rate of 3.00% per annum to double in value, you would divide 72 by 3.

$$72 \div 3 = 24 \text{ years}$$

Using the Rule of 72, you can estimate that it would take about 24 years for the investment to double in value.

1. Using the information above, write a formula that describes the Rule of 72. Use the formula to answer question 2.
2. If you wanted to double your money in 10 years, at what rate of interest would you need to invest your money?

$10 = \frac{72}{r}$ $r = \frac{72}{10}$ $r = 7.2\%$

SOLUTIONS

1. The Rule of 72 can be expressed with the following formula.

   Years to double investment = 72 ÷ interest rate

   $$y = 72 \div r$$

2. $y = 72 \div r$

   $10 = 72 \div r$

   $r = 72 \div 10$

   $r = 7.2\%$

   You would need to invest your money at an interest rate of 7.2%.

DISCUSS THE IDEAS

GUARANTEED INVESTMENT CERTIFICATES

Vyanjana has received a special gift of $5000.00 from her grandparents, which she plans to invest for the future. She has researched investment options at her bank, and has decided to buy a Guaranteed Investment Certificate (GIC). GICs guarantee that the investor will receive his or her principal as well as a fixed amount of interest.

She has narrowed her choices down to three options:

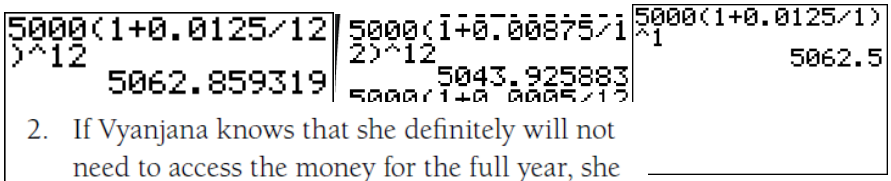
Option 1: A GIC that offers 1.125% interest per annum, compounded monthly with a one-year term. This GIC cannot be redeemed before the end of the term so Vyanjana will not be able to access her money before the end of the one-year term.

Option 2: A GIC that offers 0.875% interest per annum, compounded monthly, with a one-year term. This GIC can be redeemed before the end of the term, but if Vyanjana wants to access her money before the end of the year, her investment will earn only 0.050% interest per annum.

Option 3: A GIC that offers 1.250% interest per annum, compounded annually, with a one-year term. The GIC cannot be redeemed before the end of the term.

Working in a small group, discuss Vyanjana's investment options.

1. Calculate how much interest Vyanjana would earn with each option. For option 2, calculate how much interest Vyanjana would earn after 6 months and after the full term of the investment.
2. Suggest reasons why Vyanjana might choose each of the three options.



2. If Vyanjana knows that she definitely will not need to access the money for the full year, she should choose option 3 because it pays the most interest.

   If Vyanjana thinks she might need the money before the end of the year, she should choose option 2. She will earn less interest, but she will be able to access her money if she needs it.

   Vyanjana should not choose option 1. Like option 3, it does not allow her to access her money during the year, but it earns less interest than option 3.

SOLUTIONS

1. Calculate how much interest Vyanjana would earn with each option.

Option 1:

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$

$$A = \$5000.00\left(1 + \frac{0.01125}{12}\right)^{12}$$

$$A \approx \$5056.54$$

$$I = A - P$$

$$I = \$5056.54 - \$5000.00$$

$$I = \$56.54$$

Option 2a:

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$

$$A = \$5000.00\left(1 + \frac{0.00875}{12}\right)^{12}$$

$$A \approx \$5043.93$$

$$I = A - P$$

$$I = \$5043.93 - \$5000.00$$

$$I = \$43.93$$

Option 2b:

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$

$$A = P\left(1 + \frac{0.0005}{12}\right)^{6}$$

$$A \approx \$5001.25$$

$$I = A - P$$

$$I = \$5001.25 - \$5000.00$$

$$I = \$1.25$$

Option 3:

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$

$$A = \$5000.00\left(1 + \frac{0.0125}{1}\right)^{1}$$

$$A = \$5000.00\ (1.0125)^{1}$$

$$A \approx \$5062.50$$

$$I = A - P$$

$$I = \$5062.50 - \$5000.00$$

$$I = \$62.50$$

ACTIVITY 3.6
THE EFFECT OF DIFFERENT COMPOUNDING PERIODS

1. Calculate the interest and the final value for an investment of $4000.00 at 3.00% per annum over 2 years for the following different compounding periods. Show your answers in a table like the one below. Use any method you wish to calculate your answers.
2. Which compounding period yields the greatest interest on the investment? Which yields the least? How would knowing this affect your choice of investment?

SOLUTIONS

1.

Interest period	*Final value of investment (A)*	*Interest (I)*
Annually	$\$4000.00\left(1+\frac{0.03}{1}\right)^{(1\times 2)} \approx \$4243.60$	$243.60
Semi-annually	$\$4000.00\left(1+\frac{0.03}{2}\right)^{(2\times 2)} \approx \$4245.45$	$245.45
Quarterly	$\$4000.00\left(1+\frac{0.03}{4}\right)^{(4\times 2)} \approx \$4246.40$	$246.40
Monthly	$\$4000.00\left(1+\frac{0.03}{12}\right)^{(12\times 2)} \approx \$4247.03$	$247.03
Daily	$\$4000.00\left(1+\frac{0.03}{365}\right)^{(365\times 2)} \approx \$4247.34$	$247.34

2. The daily compounding period yields the most interest. The annual compounding period yields the least interest. Knowing this, you would choose an investment which is compounded the most times per year to accumulate the most interest.

Hang on.... HOMEWORK!!!

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Questions:
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3.2 Build Your Skills Detaild Solutions.pdf

Worksheet - Simple & Compound Interest.pdf

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