

Student Name

Mathematics Stage 5 Core

FINANCIAL MATHEMATICS A

Book 2 Solve problems involving simple interest

Version: 260207

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CONTENTS

Overview	2
Simple Interest	3
Simple Interest Graphs	11
Simple Interest Problems	14

OVERVIEW

SYLLABUS CONTENT

MA5-FIN-C-01 solves financial problems involving simple interest, earning money and spending money

Solve problems involving simple interest

- Establish and use the formula $I = Prn$ to find simple interest where I = simple interest, P = principal, r = interest rate per time period and n = number of time periods
- Apply the simple interest formula to solve problems related to investing money at simple interest rates, both algebraically and graphically

REVIEW OF PRIOR KNOWLEDGE

1 Convert these percentages to decimals.

a 40%	b 4%	c 0.4%	d 15%
e 12.5%	f 59.5%	g 0.25%	h 45.6%

2 Convert these months to years.

a 12 months	b 24 months	c 6 months	d 18 months
e 8 months	f 28 months	g 60 months	h 96 months

3 Solve these equations.

a $16 = 2x$	b $12x = 62$	c $5 \times 4x = 12$
d $100 = 2 \times x \times 14$	e $13 = 0.15x$	f $85 = 0.6 \times x \times 7$

4 Convert these decimals to percentages.

a 0.15	b 0.07	c 0.258	d 0.0255
e 0.8	f 0.002	g 0.85	h 0.0020

SIMPLE INTEREST

- **Interest** is the cost of borrowing or reward for saving money.
- The initial amount invested or borrowed is the **principal**.
- **Simple interest** is a **percentage** of the **principal**.
- The yearly percentage rate is the **interest rate**, shown as per annum (p.a.).

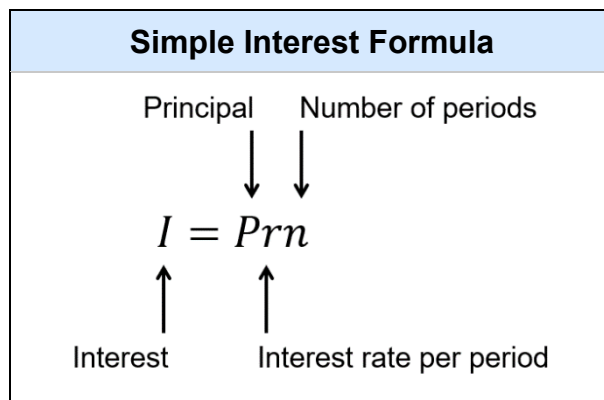
- Flo invests \$300 in an account paying simple interest at 5% per annum,
 - Work out 5% of \$300
 - Work out how much money Flo will have in her account after 1 year.
 - Work out how much money Flo will have in her account after 3 years.
- Junaid invests \$6000 in an account earning simple interest at 4% per annum,
 - Work out 4% of \$6000
 - Work out the total amount of money in Junaid's account after 5 years.
.....
- Amina invests \$2500 at 6% simple interest per annum.
Work out the value of her savings after 6 years.
.....
.....

Investigation Establishing the simple interest formula.

\$1000 is invested in a bank and 10% simple interest is paid every year.
Complete the table and describe the pattern.

Year	Interest that Year	Total Interest
0	\$0	\$0
1	$\$1000 \times 0.1 = \100	$\$100 \times 1 = \100
2	$\$1000 \times 0.1 = \100	$\$100 \times 2 = \dots\dots$
3		
4		
n		

After n years, the total interest would be $I = \$100 \times \dots\dots$
 100 could be rewritten as $I = \dots\dots \times 0.1 \times \dots\dots$
 For *any* initial amount P and interest rate r : $I = \dots\dots \times \dots\dots \times \dots\dots$



1. Read the question and identify given values.
2. Write the formula.
3. Substitute given values.
4. Solve to find the unknown

Example Calculate simple interest.

Calculate the simple interest on ^P\$4000 at 3.5% p.a. for 6 years. $r = 0.035$ n 1. Read the question 2. Formula $I = Prn$ 3. Substitute $= \\$4000 \times 0.035 \times 6$ 4. Solve $= \\$840$	Why did we write 3.5% as 0.035? <i>When working with percentages, always write them as</i>
--	--

Calculate simple interest on:

- a** \$35 000 borrowed for 4 years
at 3.6% p.a.

$$I = Prn$$

$$= \dots \times \dots \times \dots$$

$$= \dots$$

\$5040

- b** \$12 500 borrowed for 2 years
at 12.5% p.a.

$$\dots = \dots$$

$$= \dots \times \dots \times \dots$$

$$= \dots$$

\$3125

- Rate and time units must match. For a yearly interest rate, use time in years.

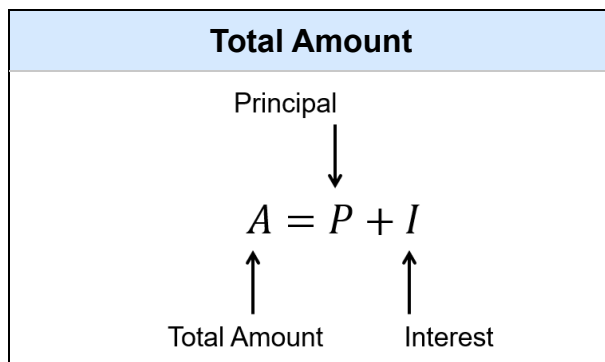
Example Calculate simple interest.

Calculate the simple interest on \$^P13 500 at 5.5% p.a. for 6 months. $r = 0.055$ $n = \frac{6}{12}$ $I = Prn$ $= \\$13\,500 \times 0.055 \times \frac{6}{12}$ $= \\$371.25$	Why did we need divide 6 by 12? <i>The interest rate is given p.a. , meaning per, so the time period must be in as well.</i> <i>To convert months to, we divide by</i>
--	---

Calculate simple interest on:

a \$8200 borrowed for 8 months at 5.6% p.a. $I = Prn$ $=$ $=$ \$306.13	b \$2500 borrowed for 18 months at 9.6% p.a. = $=$ $=$ \$360
c \$10 000 invested at 4% p.a. for 12 months. \$400	d \$18 000 borrowed for 24 months at 2.9% p.a. \$1044

- The **total amount** (borrowed or invested) equals **principal plus interest**.



Example Calculate total amount.

Calculate the total owing after 2 years if \$3000 is borrowed at 12% p.a. simple interest

$$I = Prn$$

$$= \$3000 \times 0.12 \times 2$$

$$= \$720$$

$$A = P + I$$

$$= \$3000 + 720$$

$$= \$3720$$

- a** Calculate the amount \$7000 will grow in 3 years if invested at 6.5% p.a. simple interest.

$$I = Prn$$

$$= \dots\dots\dots$$

$$= \dots\dots\dots$$

$$A = P + I$$

$$= \dots\dots\dots$$

\$8365

- b** Calculate total amount owed on \$6000 at 8% p.a. for 16 months.

\$6640

Key ideas

1. Interest is the reward for money and the cost of money.
2. Simple interest is a of the original amount invested or borrowed.
3. The interest rate should always be converted from a percentage to a
4. To calculate the total amount, we add the and

- 1 Calculate the simple interest earned if the principal is \$1000, the rate is 5% p.a. and the time is 3 years.

$$I = Prn$$

$$= \dots\dots\dots$$

$$= \dots\dots\dots$$

\$150

- 2 \$12 000 is invested at 6% p.a. for 2 years. Calculate how much interest is received.

$$I = Prn$$

$$= \dots\dots\dots$$

$$= \dots\dots\dots$$

\$1440

- 3 Calculate the simple interest received when \$7000 is invested for 2 years at 5% p.a.

$$I = Prn$$

$$= \dots\dots\dots$$

$$= \dots\dots\dots$$

\$700

- 4 Calculate the simple interest received when \$12 000 is invested for 4 years at 3% p.a.

$$I = Prn$$

$$= \dots\dots\dots$$

$$= \dots\dots\dots$$

\$1440

- 5 Calculate the simple interest earned on \$5000 at 9% p.a. for 24 months.

$$I = Prn$$

$$= \dots\dots\dots$$

$$= \dots\dots\dots$$

\$900

6 Calculate the simple interest earned on \$12 500 at 10% p.a. for 18 months.

\$1875

7 Calculate the simple interest earned on \$24 000 at 7.8% p.a. for 45 months.

\$7020

8 Calculate the amount to which \$9000 will grow in 3 years if invested at 6.5% p.a. simple interest.

$$I = Prn$$

$$= \dots\dots\dots$$

$$= \dots\dots\dots$$

\$1755

$$A = P + I$$

$$= \dots\dots\dots$$

\$10 755

9 Calculate the amount to which \$20 000 will grow in 5 years if invested at 4% p.a. simple interest.

$$I = Prn$$

$$= \dots\dots\dots$$

$$= \dots\dots\dots$$

\$4000

$$A = P + I$$

$$= \dots\dots\dots$$

\$24 000

10 If I invest \$13 500 at 7.4% p.a. simple interest, how much will I have in 4 years time?

\$17 496

11 \$8600 is invested at 9.6% p.a. for 36 months. How much does the principal grow to?

\$11 076.80

12 Wally invests \$15000 at a rate of 6% p.a. for 3 years.

a Calculate the simple interest earned.

\$2700

b Calculate the amount available at the end of 3 years.

\$17 700

13 Chloe invests \$2000 at 4% simple interest per year.

Jackson invests \$4000 at 2% simple interest per year.

Chloe says she will make more money since her interest rate is higher.

Show that she is incorrect.

They will make the same amount of money.

14 Calculate the simple interest on \$4700 invested at 4.5% p.a. for 15 months.

\$264.38

15 Annie invests \$22000 at a rate of 4% p.a. for 27 months.

Calculate the simple interest and the amount available at the end of 27 months.

\$23 980

16 A bank charges 14% p.a. simple interest.

If Lyn borrows \$2000 to be repaid over 2 years, calculate her total repayment.

\$2560

17 Markus borrows \$20000 to buy a car.

He is charged simple interest at 18% p.a. for a period of 5 years.

What is the total amount that Markus will have paid at the end of the loan period?

\$38 000

- 18** Wendy wins \$5000 during a chess tournament. She wishes to invest her winnings and has the two choices given below.

Choice 1: 8.5% p.a. simple interest for 4 years

Choice 2: 8% p.a. simple interest for 54 months

Which one gives her the greater total at the end of the time, and by how much?

Choice 2 by \$100

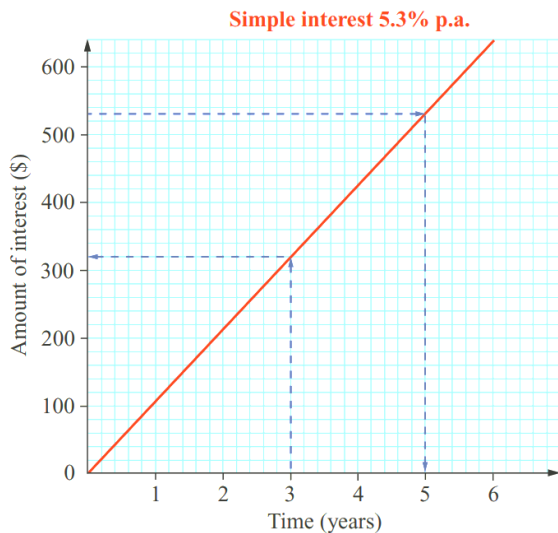
SIMPLE INTEREST GRAPHS

- Interest on the y axis.
- Time on the x axis.
- The relationship is a straight-line graph.

Example Interpret a simple interest graph.

The graph shows simple interest earned on an investment of \$2000 at 5.3% p.a. interest.

Use the graph to find:



Amount of interest earned after 3 years.

\$320.

Time taken to earn \$530 interest.

5 years.

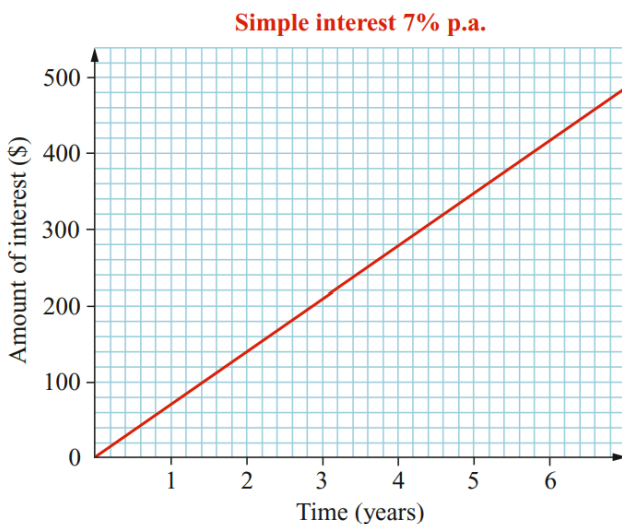
How do you use the graph to determine interest earned after 3 years?

.....

How do you use the graph to determine time take to earn \$530 interest?

.....

Answer these questions using the graph on the right.



a Amount of interest after 4 years.

\$280

b Time taken to earn \$400 interest.

5.7 years

Key ideas

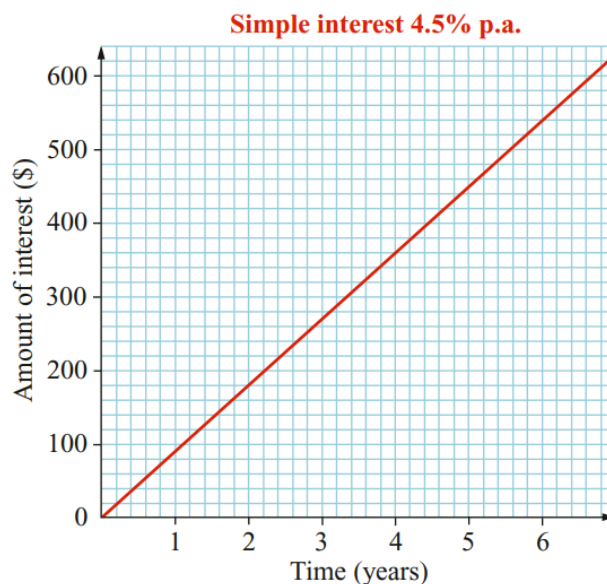
1. A simple interest graph shows a relationship.
2. On the x axis is
3. On the y axis is

- 1 Using the graph shown,
a How much interest is earned after 6 years?

\$540

- b How much time does it take to earn \$350 interest?

3.9 years

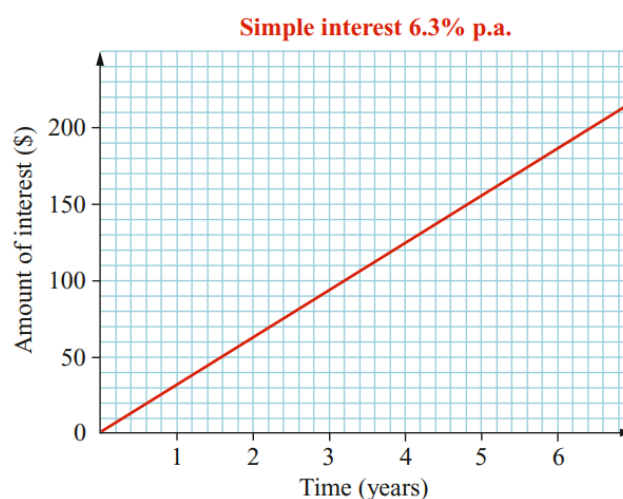


- 2 Using the graph shown,
a How much interest is earned after 2 years?

\$60

- b How much time does it take to earn \$100 interest?

3.2 years

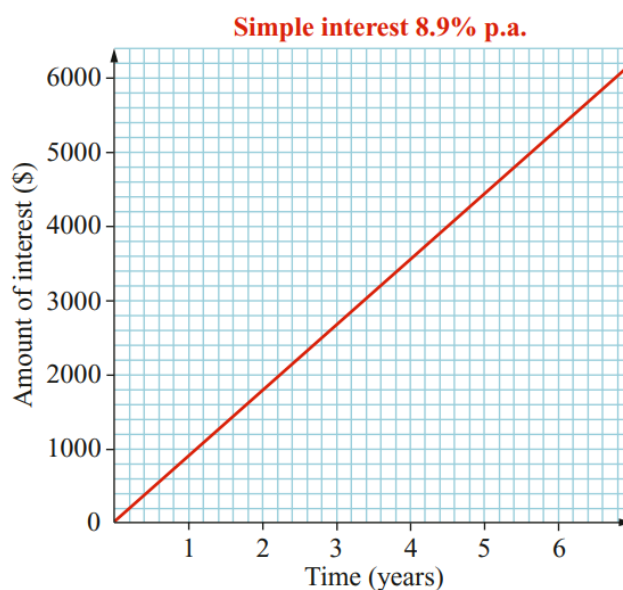


- 3 Using the graph shown,
a How much interest is earned after 4.5 years?

\$4000

- b How much time does it take to earn \$5000 interest?

5.6 years



- 4 The graph shows the simple interest earned on a principal of \$20 000 for 5 years at three different interest rates per annum.

According to this graph,

- a How much interest is earned in 5 years if the interest rate is 4%?

\$4000

- b How much interest is earned in 5 years if the interest rate is 6%?

\$6000

- c How much interest is earned in 5 years if the interest rate is 8%?

\$8000

- d How long will it take to earn \$2400 if the interest rate is 8% p.a.?

1.5 years

- e How much interest is earned at 6% p.a. after 3.5 years?

\$4200

- f How many months does it take to earn \$4500 interest at 6% p.a.?

45 months

- g How much time does it take to earn \$7400 interest at 8% p.a.?

Around 4.6 years

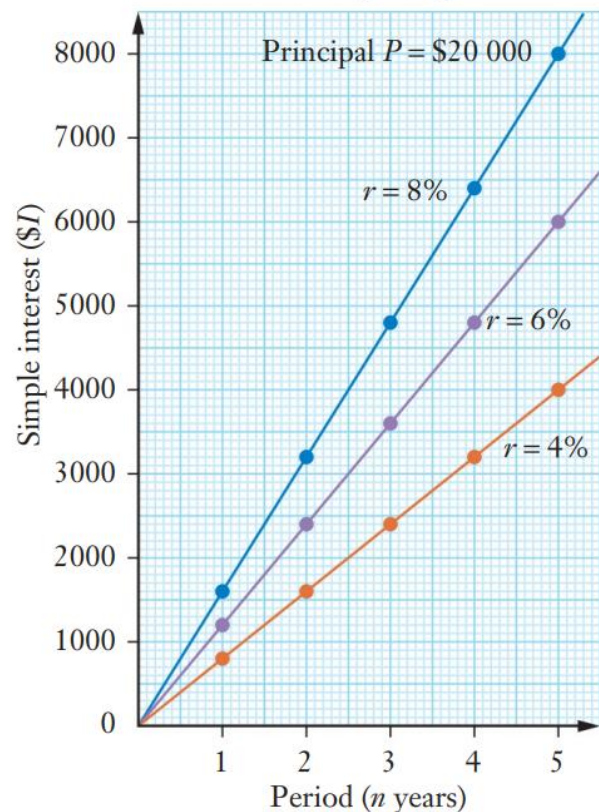
- h How much interest is earned after 21 months at 8% p.a.?

\$2800

- i What is the interest rate if \$1800 interest is earned after 27 months?

4%

Interest earned on a principal of \$20 000

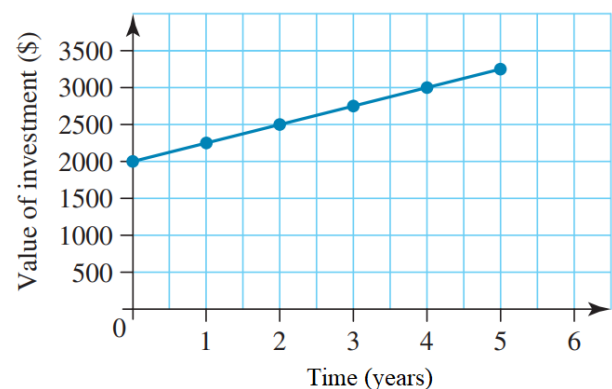


- 5 For the graph shown,
- a Explain why the graph does not start at 0 on the y axis.

The graph shows value of investment: $A = P + I$, so it includes the principal.

- b How much interest is earned in 1 year?

\$250



SIMPLE INTEREST PROBLEMS

- Simple interest problems involve finding the principal, rate, or time:
 - Read the question and identify given values.
 - Write the formula.
 - Substitute given values.
 - Simplify the equation.
 - Solve to find the unknown.

Example Calculate time.

An investment of \$3300 at 7% p.a. results in an interest of \$1386.

Calculate the amount of time invested in years.

1. Read the question

2. Formula $I = Prn$

3. Substitute $\$1386 = \$3300 \times 0.07 \times n$

4. Simplify $\$1386 = \$231 \times n$

5. Solve $\div 231 = \div 231$

$$\frac{1386}{231} = n$$

$$6 = n$$

- a Interest of \$1752 is earned from a \$7300 investment at 4% p.a.
Find how long the investment was for.

1.

2.

$$I = Prn$$

3.

$$\boxed{\text{Interest}} = \boxed{\text{Principal}} \times \boxed{\text{Rate (decimal)}} \times n$$

4.

$$\boxed{} = \boxed{} \times n$$

5.

$$\frac{\boxed{}}{\boxed{}} = n$$

$$\boxed{} = n$$

6 years

- b A \$500 investment at 6% p.a. earned \$120.
Find the amount of time invested.

1.

2.

$$\dots\dots = \dots\dots\dots$$

3.

$$\boxed{\text{Interest}} = \boxed{\text{Principal}} \times \boxed{\text{Rate (decimal)}} \times n$$

4.

$$\boxed{} = \boxed{} \times n$$

5.

$$\frac{\boxed{}}{\boxed{}} = n$$

$$\boxed{} = n$$

4 years

Example Calculate principal.

An investment at 3% p.a. for 8 years resulted in interest of \$279.60.
Calculate how much was invested at the start.

1. Read the question

2. Formula $I = Prn$

3. Substitute $\$279.60 = P \times 0.03 \times 8$

4. Simplify $\$279.60 = P \times 0.24$

5. Solve $\div 0.24 = \div 0.24$

$$\frac{279.60}{0.24} = P$$

$$\$1165 = P$$

a Interest of \$86 is earned from a 5-year investment at 4% p.a. How much was invested at the start?

1.

2. $I = Prn$

3. $\boxed{} = P \times \boxed{} \times \boxed{}$
Interest Rate (decimal) Term

4. $\boxed{} = P \times \boxed{}$

5. $\div \div$

$$\frac{\boxed{}}{\boxed{}} = P$$

$$\boxed{} =$$

\$430

b A 4-year investment earned \$14 016 at 12% p.a. What was the original investment?

1.

2. $\dots\dots = \dots\dots\dots$

3. $\boxed{} = P \times \boxed{} \times \boxed{}$
Interest Rate (decimal) Term

4. $\boxed{} = P \times \boxed{}$

5. $\div \div$

$$\frac{\boxed{}}{\boxed{}} = P$$

$$\boxed{} =$$

\$29200

- When finding interest rate, multiply your answer by 100 to get a percentage.

Example Calculate interest rate.

Calculate the interest rate when $\overset{P}{\$5000}$ earns $\overset{I}{\$150}$ interest in $\overset{n}{2}$ years.

1. Read the question

2. Formula $I = Prn$

3. Substitute $\$150 = \$5000 \times r \times 2$

4. Simplify $\$150 = \$10000 \times r$

5. Solve $\div 10000 = \div 10000$

$$\frac{150}{10000} = r$$

$$0.015 =$$

$$1.5\% =$$

a \$3500 is invested for 3 years.
The amount of interest earned is \$735.
Calculate the interest rate.

1.

2. $I = Prn$

3. $\$735 = \$3500 \times r \times 3$

4. =

5. $\frac{\boxed{}}{\boxed{}} = r$

..... = r (decimal)

..... % = r

7%

b \$1280 is earned from \$4000 invested for 4 years. Calculate the interest rate.

1.

2. =

3. =

4. =

5.

8%

Key ideas

- To use formulas to solve problems, follow these steps:
-the formula $I = Prn$.
- known values into the equation
- for the unknown by applying operations to sides.

1

- a Alvi invests \$5000 at 8% p.a. simple interest and wants to earn \$1200 in interest. For how many years should Alvi invest his money?

$$I = Prn$$

	=		×		×	n
Interest		Principal		Rate (decimal)		

↓

	=		×	n
--	---	--	---	-----

÷ ÷

	=	n
--	---	-----

÷

	=	n
--	---	-----

3 years

- b Remy invests \$2500 at 8% p.a. simple interest, for a period of time, to produce \$50 interest. For how long did she invest the money?

$$I = Prn$$

	=		×		×	n
Interest		Principal		Rate (decimal)		

↓

	=		×	n
--	---	--	---	-----

÷ ÷

	=	n
--	---	-----

÷

	=	n
--	---	-----

0.25 years (3 months)

- c Sam earns \$288 interest on his \$1600 investment. If the interest was calculated at 4% p.a., how many years did Sam invest the money for?

$$I = Prn$$

.....=.....

.....=.....

.....=.....

.....=.....

4.5 years

- d How many months will it take to earn \$600 interest at 5% p.a. on an investment of \$8000?

$$I = Prn$$

.....=.....

.....=.....

.....=.....

.....=.....

1.5 years (18 months)

- a Calculate the principal amount that earns \$500 simple interest over 3 years at a rate of 8% p.a. Round to the nearest cent.

$$I = Prn$$

$$\boxed{} = P \times \boxed{} \times \boxed{}$$

Interest Rate (decimal) Term

$$\boxed{} = P \times \boxed{}$$

÷ ÷

$$\frac{\boxed{}}{\boxed{}} = P$$

$$\boxed{} =$$

\$2083.33

- b Interest of \$374.50 is earned from a 5-year investment at 7% p.a. Find the principal invested.

$$I = Prn$$

$$\boxed{} = P \times \boxed{} \times \boxed{}$$

Interest Rate (decimal) Term

$$\boxed{} = P \times \boxed{}$$

÷ ÷

$$\frac{\boxed{}}{\boxed{}} = P$$

$$\boxed{} =$$

\$1070

- c Interest of \$914.40 is earned from a 3-year investment at 8% p.a. Find the principal invested.

$$I = Prn$$

..... =

..... =

..... =

..... =

\$3810

- d Interest of \$8127 is earned from a 7-year investment at 6% p.a. Find the principal invested.

$$I = Prn$$

..... =

..... =

..... =

..... =

\$19 350

3

- a** Ivan invested \$3000 for 4 years and earned \$504 in interest. Calculate the rate of simple interest as a percentage.

$$I = Prn$$

.....=.....
.....=.....
.....=.....
.....=.....

4.2%

- b** Kim invested \$6000 for 5 years and earned \$2100 in interest. What was the annual rate of simple interest?

$$I = Prn$$

.....=.....
.....=.....
.....=.....
.....=.....

7%

- c** Lauren invested \$17 000 for 4 years, earning \$3128 in interest. What was the annual rate of simple interest?

$$I = Prn$$

.....=.....
.....=.....
.....=.....
.....=.....

4.6%

- d** Bank East advertises \$450 interest a year on an investment of \$7500 . Calculate the simple interest rate for this investment.

$$I = Prn$$

.....=.....
.....=.....
.....=.....
.....=.....

6%

4

a Joy invested \$2800 at 3.5% p.a. simple interest. How long would it take to earn \$490 in interest?

5 years

b If \$5000 yields interest of \$6000 interest in 12 years, find the simple interest rate.

10%

c Find the annual simple interest rate needed for \$4000 to earn \$500 in 2 years.

6.25%

d Harry invested \$13 000 at 6% p.a. simple interest. How long would it take to earn \$4680 in interest?

6 years

e A 2-year investment that has an interest rate of 9% p.a. yields interest of \$129.60. Find how much was invested.

\$720

f Interest of \$3354 is earned from a \$4300 investment at 13% p.a. How long was it invested for?

6 years

g Interest of \$620.40 is received from a \$940 investment at 6% p.a. Calculate how long the investment was for.

11 years

h After 4 years, an investment of \$13000 has earned \$1092 in simple interest. What is the annual interest rate?

2.1%

5 Some questions will give you the total amount A . You can find interest using $I = A - P$

a An investment grows from \$18000 to \$22320. What is the interest earned?

\$4320

b Find the number of years this took if the interest rate was 6% p.a. simple interest.

4 years

Hence solve the following:

c Marta invests \$600 at 4% simple interest per annum. After n years, she has a total of \$720 in her bank account. Work out the value of n .

5 years

d Faith invests \$850 at $r\%$ simple interest per year. After 3 years, she has \$1054 in her account. Work out the value of r .

8%

6 Complete this table of values for I , P , R and N

P	R	N	I
\$700	5% p.a.	4 years	\$140
\$2000	7% p.a.	3 years	\$420
\$3500	3% p.a.	22 months	\$192.50
\$750	2.5% p.a.	30 months	\$46.88
\$22 500	3% p.a.	3 years	\$2025
\$1770	4% p.a.	5 years	\$354

7 HSC Standard 2 Sample Question Band 4

George makes a single deposit of \$9000 into an account that pays simple interest. After 4 years, George's account has a balance of \$10 350. What simple interest rate did George receive on his investment?

3.75% p.a.

8 2010 HSC Standard 2 Band 4

Minjy invests \$2000 for 1 year and 5 months. The simple interest is calculated at a rate of 6% per annum. What is the total value of the investment at the end of this period?

\$2170

9 2013 HSC Standard 2 Band 4

Polly borrowed \$11000. She repaid the loan in full at the end of two years with a lump sum of \$12000. What annual simple interest rate was she charged?

4.55% p.a.

10 2013 HSC Standard 2 Band 4

Lynne invests \$1000 for a term of 15 months. Simple interest is paid on the investment at a rate of 3.75% per annum. How much will Lynne's investment be worth at the end of the term?

\$1046.88

11 2019 HSC Standard 2 Band 6

What is the interest earned, in dollars, if \$800 is invested for x months at a simple interest rate of 3% per annum?

- A. $2x$
- B. $24x$
- C. $200x$
- D. $2400x$

A