

MPM 2D0 - Linear Systems – Interest/Investment Problems

Vocabulary

Investment – something you buy with your money in order to earn money. Common types of investments would be stocks, bonds, GIC's (guaranteed investment certificates) or even a bank account.

Principal – the amount of money you invest.

Per cent - % – means 'for every 100'. ($3\% = \frac{3}{100} = .03$)

Per annum – for each year

Interest – the amount paid to you for investing your money. It is paid as a percentage of your investment that year. For example 2% per annum would mean every year you would earn 2% of your principal. If you invested \$100 for a year at 2% you would earn \$2.00 at the end of the year.

p.149#10

A principal of \$500 is invested; part at 7% per annum and the rest at 10% per annum. After one year, the total interest earned was \$44. How much was invested at each rate?

Let x be the amount of money invested at 7% per annum.

Let y be the amount of money invested at 10% per annum.

$$x + y = 500 \quad (1)$$

$$.07x + .10y = 44 \quad (2)$$

To eliminate the decimals, multiply (2) x 100

$$7x + 10y = 4400 \quad (3)$$

$$x + y = 500 \quad (1)$$

From (1) $y = 500 - x$

Sub. y into (3) $7x + 10(500 - x) = 4400$

$$7x + 5000 - 10x = 4400$$

$$-3x = -600$$

$$x = 200$$

Sub. x into (1) $200 + y = 500$

$$y = 300$$

\$200 was invested at 7% per annum and \$300 at 10% per annum.

MPM 2D0 – Interest/Investment Problems

Percent to Fraction to Decimal

$$3\% = \frac{3}{100} = .03$$

$$8.75\% =$$

$$3.5\% = \frac{3.5}{100} = .035$$

$$1.25\% =$$

$$3\frac{3}{4}\% = 3.75\% = \frac{3.75}{100} = .0375$$

$$2.4\% =$$

$$9\frac{1}{4}\% = 9.25\% = \frac{9.25}{100} = .0925$$

$$2\frac{3}{4}\% =$$

$$5.3\% = \frac{5.3}{100} = .053$$

$$5\frac{1}{2}\% =$$

James received a \$25 000 bonus from his boss last year. He invested some of the money at $2\frac{3}{4}\%$ p.a. and the rest at 3.2% p.a. The total interest earned on his investments at the end of one year was \$750.50. How much did James invest at each rate of return?

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Let x be the amount invested at $2\frac{3}{4}\%$ p.a.

Let y be the amount invested at 3.2% p.a.

$$x + y = 25\,000 \quad (1)$$

$$.0275x + .032y = 750.50 \quad (2)$$

$$(2) \times 10\,000 \quad 275x + 320y = 7\,505\,000 \quad (3)$$

$$\text{From (1)} \quad y = 25\,000 - x$$

$$\begin{aligned} \text{Sub. into (3)} \quad & 275x + 320(25\,000 - x) = 7\,505\,000 \\ & 275x + 8\,000\,000 - 320x = 7\,505\,000 \\ & -45x = 7\,505\,000 - 8\,000\,000 \\ & -45x = -495\,000 \\ & x = 11\,000 \end{aligned}$$

$$\begin{aligned} \text{Sub. } x \text{ into (1)} \quad & 11\,000 + y = 25\,000 \\ & y = 14\,000 \end{aligned}$$

\therefore James invested \$11 000 at $2\frac{3}{4}\%$ p.a. and \$14 000 at 3.2% p.a.

Interest Type Problems

MPM 2D Solving Word Problems - Interest Problems

When dealing with interest questions we are often concerned with the interest earned on money. Recall that interest = principal \times rate \times time.

In most of the questions we will be dealing with interest for a year so we can calculate interest = principal \times rate

For example
 Interest on \$2000 at 4% = 2000×0.04
 Interest on \$4000 at $x\%$ is $4000x$

Example

\$5000 was invested part at 9% and the rest at 11%. After one year the interest earned was \$520. How much was invested at each rate?

Solution

Let x represent the amount invested at 9% and y the amount invested at 11%

$x + y = 5000$ (1) an equation for the amounts invested
 $0.09x + 0.11y = 520$ (2) an equation for the interest amounts

(1) $\times 0.09$ $0.09x + 0.09y = 450$
 (2) $0.09x + 0.11y = 520$
 Subtract (2) - (1) $0.02y = 70$
 $y = 3500$
 $x = 1500$

Check (left for you to do)

\$1500 was invested at 9% and \$3500 at 11%

Homework page 149 #10, 11, 12, 14 plus the handout questions.

Example : Mike invested \$8000, part at 9% per annum and the remainder at 12%/a. After one year the total interest earned on these investments was \$810. How much did he invest at each rate?

Let x be the amount invested at 9%/a. in \$
 Let y be the amount invested at 12%/a. in \$

Total money invested: $x + y = 8000$ substitute $y = 3000$ into (1):

money earned: $0.09x + 0.12y = 810$ (2)

remove decimals: $9x + 12y = 81000$

for \rightarrow (1) $\times 9$: $9x + 9y = 72000$

elimination: $3y = 9000$

to work: $y = 3000$

$x + 3000 = 8000$

$x = 5000$

\therefore \$5000 was invested at 9% and

\$3000 was invested at 12%.

PROBLEMS (answers in brackets)

- Pierre invested \$8000, part at 9%/a and the remainder at 10%/a. After one year his total interest from these investments was \$740. How much did he invest at each rate? (6000, 2000)
- The student council invested \$8000, part at 7.5% and the remainder at 8.5%/a. The total interest, after one year, from these investments was \$480. How much was invested at each rate? (3000, 5000)
- Joe invested two sums of money, part at 8%/a and the remainder at 7%/a. After one year the interest from those investments totalled \$380. If he had reversed the investments, his interest would have been \$370. What was his total original investment? (3000, 2000)
- Jill invested \$2000, part at 12%/a and the remainder at 8%/a. At the end of one year the amounts from each investment were equal. How much was invested at each rate? (800, 1200)
- Fritz invested \$3000, part at 8%/a and the remainder at 7%/a. At the end of one year the interest from the 8% investment was \$60 more than the interest from the 7% investment. How much was invested at each rate? (1800, 1200)
- How would you invest \$6400, part at 8%/a and the remainder at 6%/a so that at the end of one year the interest from the 8% investment will be double the interest from the 6% investment? (3240, 3160)