Example 1

Suppose John lends \$10,000 to a bank and suppose that the bank agrees to pay simple interest at 10% per annum. Suppose further that John will require repayment of his lent funds' long with the simple interest earned, in three years' time. How much money will John be paid at maturity?

Given that we are operating with simple interest, John earns interest on his initial investment at the rate of 10% each year. the cash flow at the end of each year is:

$$At\ 10\%\ simple\ \text{int}erest,\ John\ earns\ \$3,000\ \text{int}erest.$$

$$After\ 1\ year,\ John\ earns\ 0.10 \times \$10,000 = \$1,000\ in\ \text{int}erest.$$

$$John\ also\ earns\ the\ same\ amount\ at\ the\ end\ of\ the\ \text{sec}ond\ and\ third\ year.$$

$$Hence\ after\ 3\ years,\ John\ has\ a\ total\ of\ \$13,000.$$

Given the following notation, the formulae for I and A in terms of the other variables can be determined. Note that:

P = principal (i.e. the amount lent or invested)

r = rate of simple interest

t = term of investment

I = interest earned

A = accumulated value of original investment

Following the example immediately before, we have:

$$I = P \times r \times t$$

Therefore A = P + I. Hence:

$$A = P + I$$

$$A = P + Prt$$

$$A = P(1 + rt)$$

Note that t can be a positive integer or a positive real number. If any three of A, P, r or t are given, the other one can be calculated.

Example 2

Suppose I want to be paid \$10,000 in two and a half years' time. Interest is quoted 8% per annum simple. Find the amount that I need to invest today.

$$Given: t = 2.5$$

$$A = \$10,000$$

$$r = 0.08$$

$$A = P(1 + rt)$$

$$P = \frac{A}{1 + rt}$$

$$P = \frac{10,000}{1 + (2.5 \times 0.08)}$$

$$P = \$8,333.33$$

Example 3

Suppose you invested \$10,000 on 23 September 2010. Find the accumulated value on 29 November 2010 assuming 8% per annum simple interest applies.

$$Given\ that:$$

$$P = \$10,000$$

$$t = \frac{67}{365}$$

$$r = 0.08$$

$$A = P(1 + rt)$$

$$A = 10,000(1 + [0.08 \times \frac{67}{365}])$$

$$A = \$10,146.85$$

Application of Simple Interest

- Examples of commercial bills include bank accepted bills and treasury notes.
- These financial instruments require an amount to be paid at a specific time in the future.
- The date of this future payment is called the **MATURITY DATE** of the bill.
- The bill is sold at a date prior to the maturity date at a discount to the amount required to be paid at maturity.
- The amount of this discount is often calculated using simple interest.
- When one invests in a Bank Accepted Bill, one purchases the face (maturing) value at a discount. The full face value of the Bill is paid to the investor at maturity.
- The difference between the purchase price and the face value represents the interest earned.

It is given that:

Price of Bill = Face Value - Discount Amount

Face Value = Price + Interest Earned

Example 4

Consider a bank bill which will mature on 31 August this year. Suppose that the bill was purchased on 21 July this year. The maturity value (also called the **FACE VALUE**) of the bill is \$100,000. Find the price paid for the bill on 21 July so that the holder of the bill earns 6% per annum simple interest.

$$Given\ that:$$

$$r = 0.06$$

$$t = \frac{41}{365}$$

$$A = \$100,000$$

$$Then\ P = \frac{A}{1 + rt}$$

$$P = \frac{100,000}{1 + (0.06 \times \frac{41}{365})}$$

Simple Discount

- Under simple interest, the amount of interest is calculated by applying the simple interest rate to the amount of money present at the onset (i.e. **beginning**) of the investment period.
- Under **SIMPLE DISCOUNT**, the amount of the discount is calculated by applying the simple discount rate to the amount of money present at the **end** of the investment period.

Example 5

Consider again the bank bill from the previous example. There was a face value of $100,000 due to be paid on 31 August (i.e. at the end of the investment period). The bill is purchased on 21 July in the same year as the maturity date. Find the price paid on 21 July for the bill so that the holder earns 6% per annum simple discount.

The amount of the discount is calculated by starting with the maturity value and applying a 6% discount to this value for a period of 41 days. The amount of the discount is therefore:

$$100,000 \times 0.06 \times \frac{41}{365} = 673.97$$

The price of the bill is therefore:
100,000 - 673.97 = $99,326.03

Given the following notation, a formulae can be formulated for D and A in terms of the other variables, given that:

P = amount of original investment
d = rate of simple discount
t = term of investment
D = discount earned
A = accumulated value of original investment

$$A - P = D$$
$$D = A \times d \times t$$
$$So\ P = A - D$$
$$P = A - (Adt)$$
$$P = A(1 - dt)$$
$$and\ A = \frac{P}{1 - dt}$$

From the bank bill example it should be clear to you that a simple interest rate of 6% is not equivalent to a simple discount rate of 6%. The bank bill had a different price when it was priced to