

Substitution

Introduction

This leaflet revises the way in which symbols in formulas are replaced by actual numerical values - a process known as substitution. You will need a calculator to check these examples.

Substitution

Substitution is revised here by means of examples.

Example

Find the value of $A = xy$ when $x = 8$ and $y = 4$.

Solution

We replace the letters x and y by their numerical values. Remember that xy means the product of x and y - that is we multiply x and y together.

$$A = xy = (8)(4) = 32$$

Example

Find the value of $I = Pin$ when $P = 100$, $i = 0.05$ and $n = 3$.

Solution

We replace the letters P , i and n by their numerical values:

$$I = Pin = (100)(0.05)(3) = 15$$

Example

Find the value of $V = \pi r^2 h$ when $r = 3$ and $h = 7$.

Solution

$$V = \pi r^2 h = \pi(3^2)(7) = 63\pi = 197.920 \quad (\text{correct to three decimal places})$$

Example

Find the value of $S = P(1 + i)^n$ when $P = 500$, $i = 0.075$ and $n = 4$.

Solution

Substitute the given values:

$$S = 500(1 + 0.075)^4$$

Remember to perform the operation in the brackets first and then raise your answer to the power 4 before multiplying by 500. The correct answer is 667.735 (correct to 3 decimal places).

Example

Find the value of $(1 + i)^{-n}$ when $i = 0.03$ and $n = 8$.

Solution

$$(1 + i)^{-n} = (1 + 0.03)^{-8} = 1.03^{-8} = 0.789 \quad \text{to three decimal places}$$

Example

Find the value of $(1 + i)^n - 1$ when $i = 0.015$ and $n = 9$.

Solution

Substituting the given values

$$(1 + i)^n - 1 = (1 + 0.015)^9 - 1 = (1.015)^9 - 1 = 0.143 \quad \text{to three decimal places}$$

Example

Find the value of $\frac{i}{(1 + i)^n - 1}$ when $n = 10$ and $i = 0.11$.

Solution

$$\begin{aligned} \frac{i}{(1 + i)^n - 1} &= \frac{0.11}{(1 + 0.11)^{10} - 1} \\ &= \frac{0.11}{1.11^{10} - 1} \\ &= 0.060 \quad \text{to three decimal places} \end{aligned}$$

Example

Find the value of $\frac{(1 + i)^n - 1}{i(1 + i)^n}$ when $i = 0.02$ and $n = 12$.

$$\begin{aligned} \frac{(1 + i)^n - 1}{i(1 + i)^n} &= \frac{1.02^{12} - 1}{0.02(1.02^{12})} \\ &= 10.575 \quad \text{to three decimal places} \end{aligned}$$

Exercise

1. Find the value of $\frac{(1 + i)^n - 1}{i(1 + i)^n}$ when $i = 0.03$ and $n = 5$.

Answer

1. 4.580 (3dp).