Revision

The volume for a cylinder is given by the formula $V = \pi r^2 h$ where r is the radius, and h is the height. Find the following to three significant figures.

a) the volume of a cylindrical tin can of radius 10 cm and height 15 cm

b) the height of a cylinder of radius 4 cm if its volume is 60 cm^3

c) the radius, in cm, of cable with volume 50 cm^3 and length 45 cm.

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Solution

a) 4710 cm^3

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Solution

a) 4710 cm^3

b) 1.19 cm

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c) the radius, in cm, of cable with volume 50 cm^3 and length 45 cm.

Solution

a) 4710 cm^3 b) 1.19 cm c) 0.595 cm

Rearranging Formulae

Standard

MS-A1 Formulae and Equations

updated: 2021-01-21

Learning Outcome

Topic:

Rearranging Formulae

Syllabus:

- change the subject of a formula

Activities/Tasks:

- Cambridge Ex 3E Q1-21

Formula Rearrangement

By performing operations to both sides of a formula, they can be **rearranged** to make **equivalent** formulae where other variables are the subjects.

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$$V = \pi r^2 h$$
$$V \div \pi r^2 = \pi r^2 h \div \pi r^2$$

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By performing operations to both sides of a formula, they can be **rearranged** to make **equivalent** formulae where other variables are the subjects.

For example

$$\begin{aligned} V &= \pi r^2 h \\ V \div \pi r^2 &= \pi r^2 h \div \pi r^2 \\ \frac{V}{\pi r^2} &= h \end{aligned}$$

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V &= \pi r^2 h \\
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h &= \frac{V}{\pi r^2}
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r^2 &= \frac{V}{\pi h} \\
\sqrt{r^2} &= \sqrt{\frac{V}{\pi h}} \\
r &= \sqrt{\frac{V}{\pi h}} \qquad (r > 0)
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$$

Example 1

Make a the subject of $2a - 7b = 23$.

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2a - 7b &= 23 \\
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Make a the subject of $2a - 7b = 23$.

Solution

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\begin{aligned}
2a - 7b &= 23 \\
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2a &= 23 - 7b \\
\frac{2a}{2} &= \frac{23 - 7b}{2}
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\begin{aligned}
2a - 7b &= 23 \\
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2a &= 23 - 7b \\
\frac{2a}{2} &= \frac{23 - 7b}{2} \\
a &= \frac{23 - 7b}{2}
\end{aligned}
$$

Rearranging then substituting

Previously, during formula substitution, the variables were replaced by numbers and then the equation was solved. However, often we need to substitute several values for the unknowns and solve the equation for each case. In this situation it is quicker to **rearrange** the formula **before substituting**.

Example 2

The surface area of a sphere is given by $A = 4\pi r^2$ where r is the sphere's radius.

a) Rearrange this formula to make r the subject.

b) Hence find the radius to 3 significant figures when the surface area is:

i) 10 cm^2 ii) 20 cm^2 iii) 30 cm^2

Example 2

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a) $A = 4\pi r^2$

$A \div 4\pi = 4\pi r^2 \div 4\pi$

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$r = 1.55$ cm

Today’s work

- Cambridge Ex 3E Q1-21