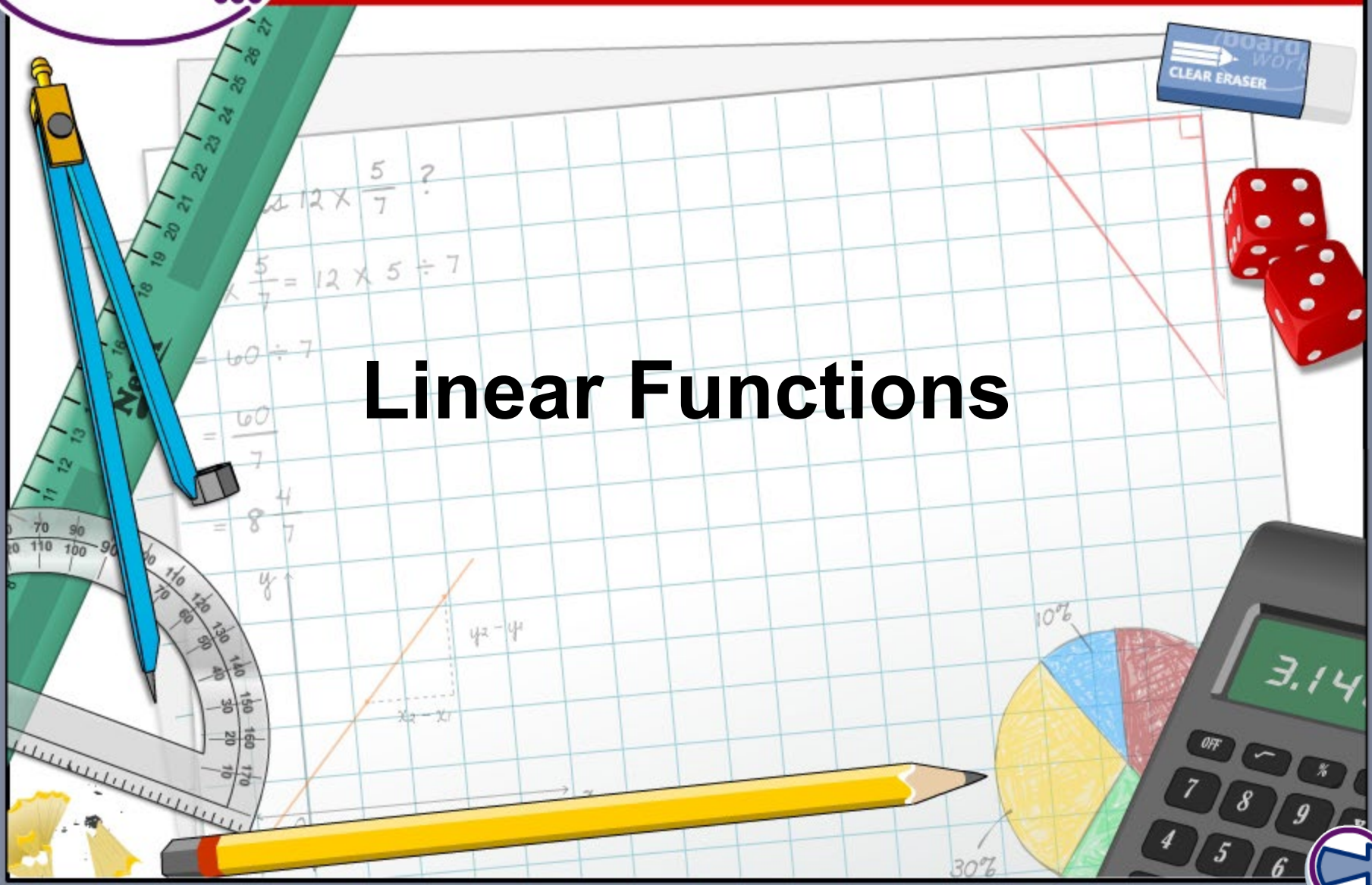


Linear Functions

Information

Common core icons

This icon indicates a slide where the Standards for Mathematical Practice are being developed. Details of these are given in the Notes field.

Slides containing examples of mathematical modeling are marked with this stamp.

This icon indicates an opportunity for discussion or group work.

The **Standards for Mathematical Practice** outlined in the Common Core State Standards for Mathematics describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.

These are:

1) Make sense of problems and persevere in solving them.

2) Reason abstractly and quantitatively.

3) Construct viable arguments and critique the reasoning of others.

4) Model with mathematics.

5) Use appropriate tools strategically.

6) Attend to precision.

7) Look for and make use of structure.

8) Look for and express regularity in repeated reasoning.

This icon indicates that the slide contains activities created in Flash. These activities are not editable.

This icon indicates teacher's notes in the Notes field.

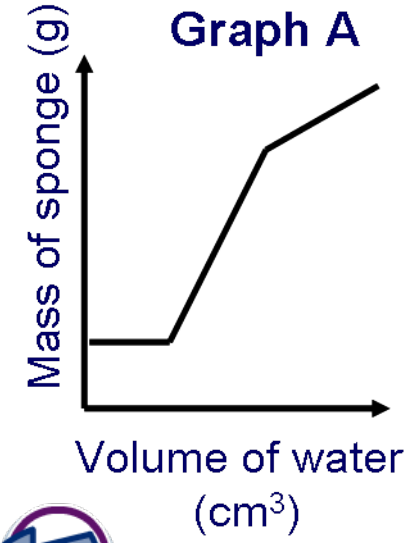
Which graph is correct?

In an experiment, a group of students poured water onto a sponge and weighed it at regular intervals.

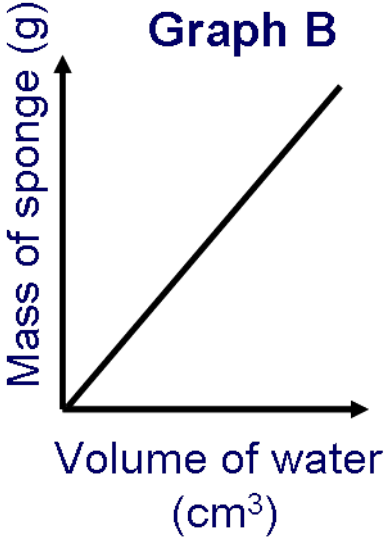
Each time, the sponge soaked up all the water.

Which graph is most likely to show their results?

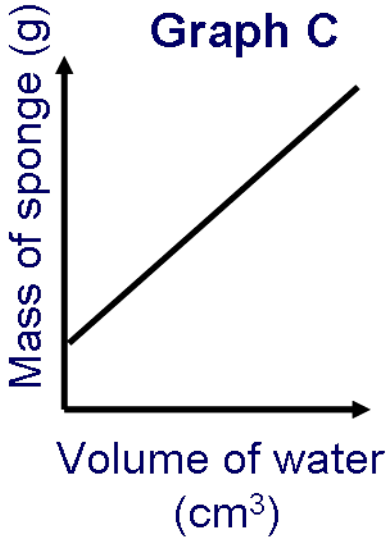
Graph A



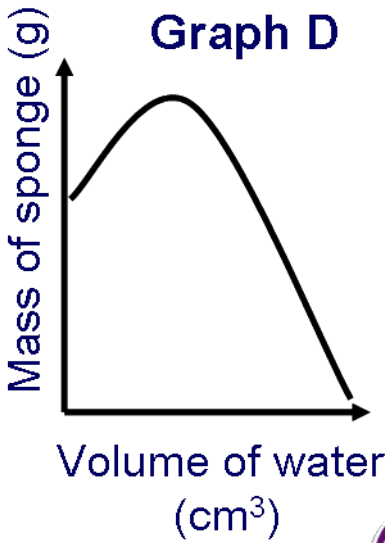
Graph B



Graph C

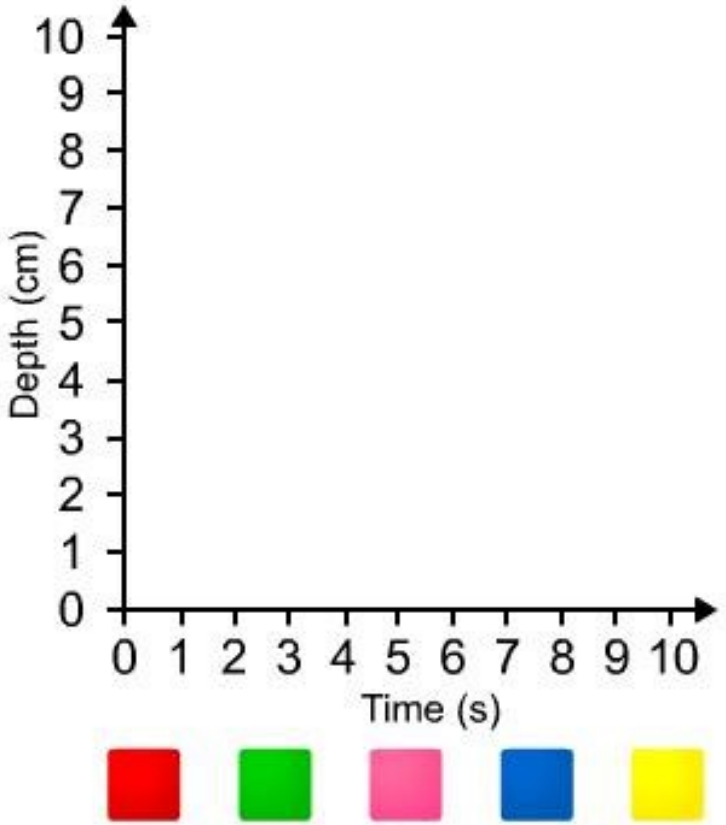


Graph D



Filling flasks

Press on a flask to fill it and see the graph of it being filled



Which flask fills with a linear rate?

Linear relationships

We say that two quantities have a **linear relationship** when one quantity increases or decreases at the **same rate**, regardless of the value of the other quantity.

The cost of a call varies linearly with the duration of the call. An extra minute makes the total cost increase by the same amount, whether it is the second minute or the hundredth minute.

The speed of an object falling to the ground does **not** vary linearly with height. The speed during the first 5 feet **does not** increase by the same amount as the speed during the last 5 feet.

What if the call had a connection charge?

Equation of a straight line

When two quantities, x and y, vary linearly with each other, we can link them with the equation:

$$y = mx + b$$

where m and b both have a constant value.

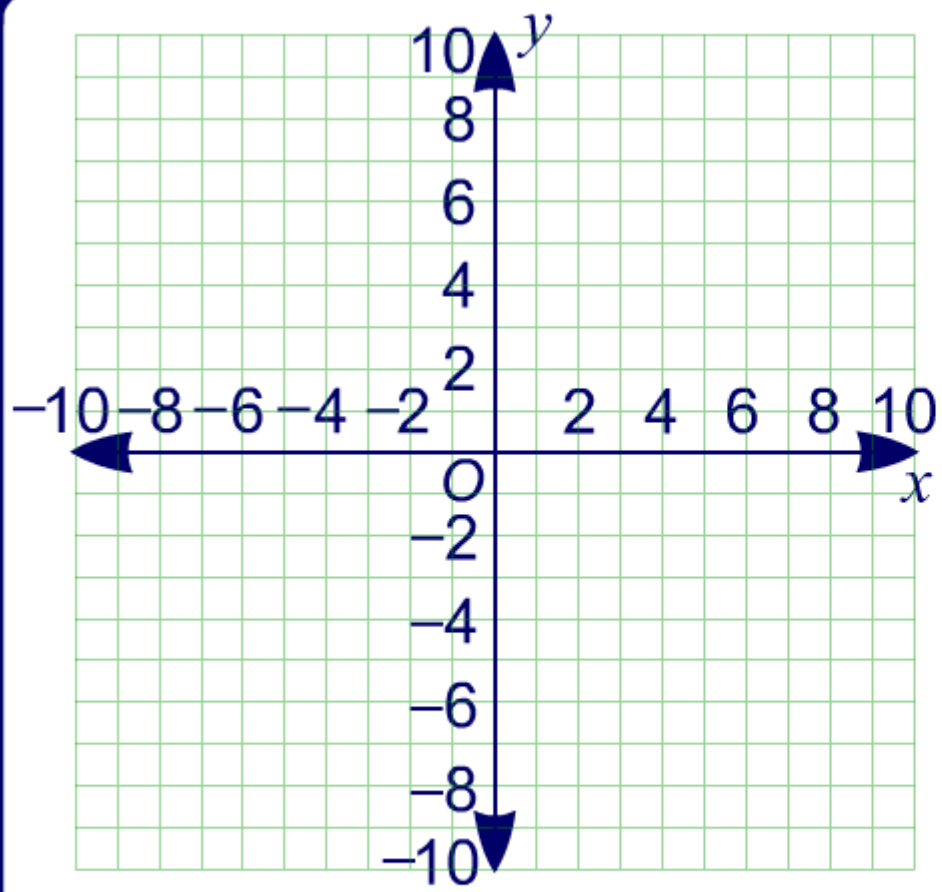
What do m and b represent?

This is a **linear function**.

The word "**line**ar" comes from the word "**line**."

The graph of $y = mx + b$ will always be a straight line.

Drawing graphs of functions



Choose a function and press the buttons below to plot it on the graph.

$y = 5x + 1$

x	−3	−2	−1	0	1	2	3
y							

show line

show crosshair

Writing functions

Devan's family buy solar heating panels.
The panels cost $1000 to install, but save $300 per month.

How can we write a function to show the relationship between money saved and time?

We can approach this problem in several ways. We can write the function:

- directly from the word problem
- using a table of values
- using a graph.

Using tables

Write the function between money saved and time using a table of values.

The panels cost $1000 to install and save $300 per month:

Time, t, in months	0	1	2	3	4	5
Savings, s, in $	–1000	–700	–400	–100	200	500

What is the initial value? –1000

What is the rate of change of the variables? 300

Write the function: **Savings, s = 300t – 1000**

Using graphs

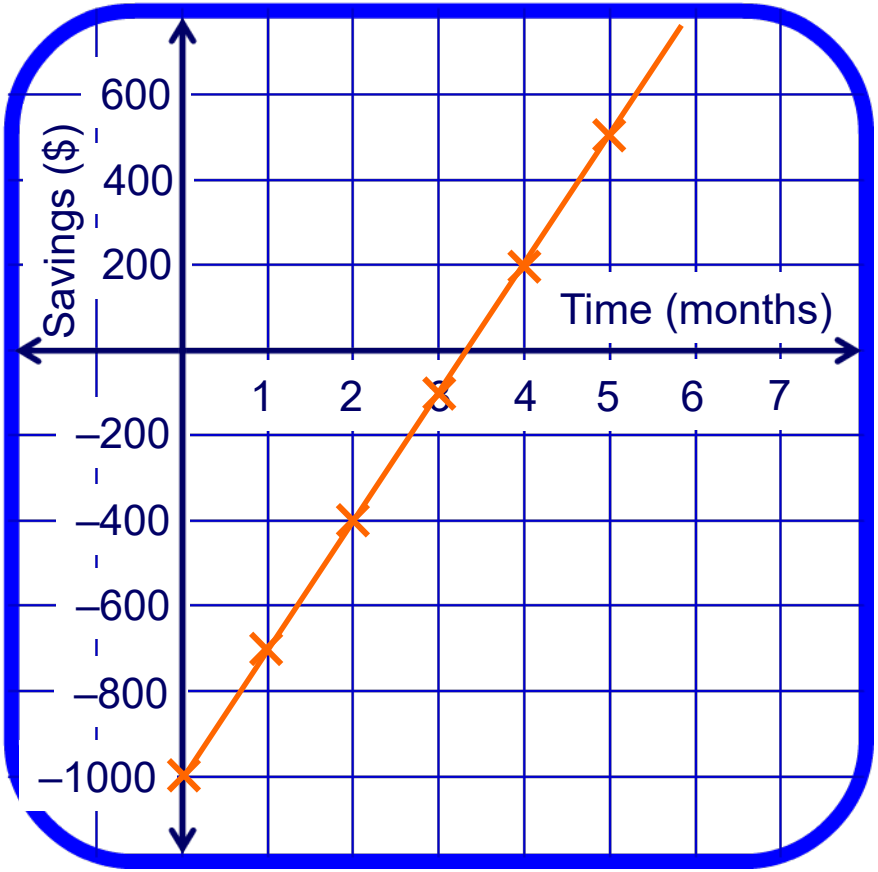
Use the table to plot a graph of this information.

The initial value is –$1000.

This is the y-intercept.

The rate of change of the variables is 300 dollars per month.

This is the slope of the line.



Time, t, in months	0	1	2	3	4	5
Savings, s, in $	–1000	–700	–400	–100	200	500

Using words

Christos joins a track club. There is a $25 joining fee and a $10 fee every time he uses the facilities. Write a function to describe the relationship between the cost, c, and the number of uses, n.

Click the buttons for help:

Analyze

Variables

Constants

Substitute

Interpreting graphs I

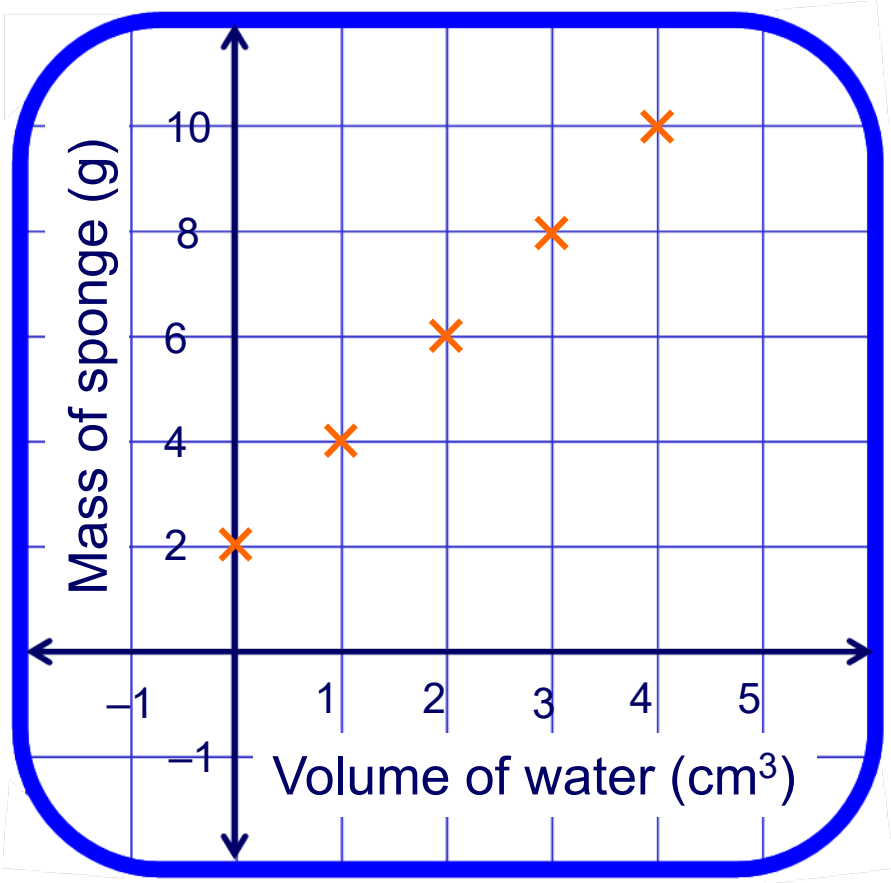
A group of students poured water onto a sponge and weighed it at regular intervals to produce this graph.

The general form for a linear function is $y = mx + b$.

In this specific example, what quantities do m and b represent?

b is equal to the mass of the **dry** sponge.

m is the ratio of the mass of the sponge to the volume of water.



Interpreting graphs II

Use the graph to find the mass of the dry sponge.

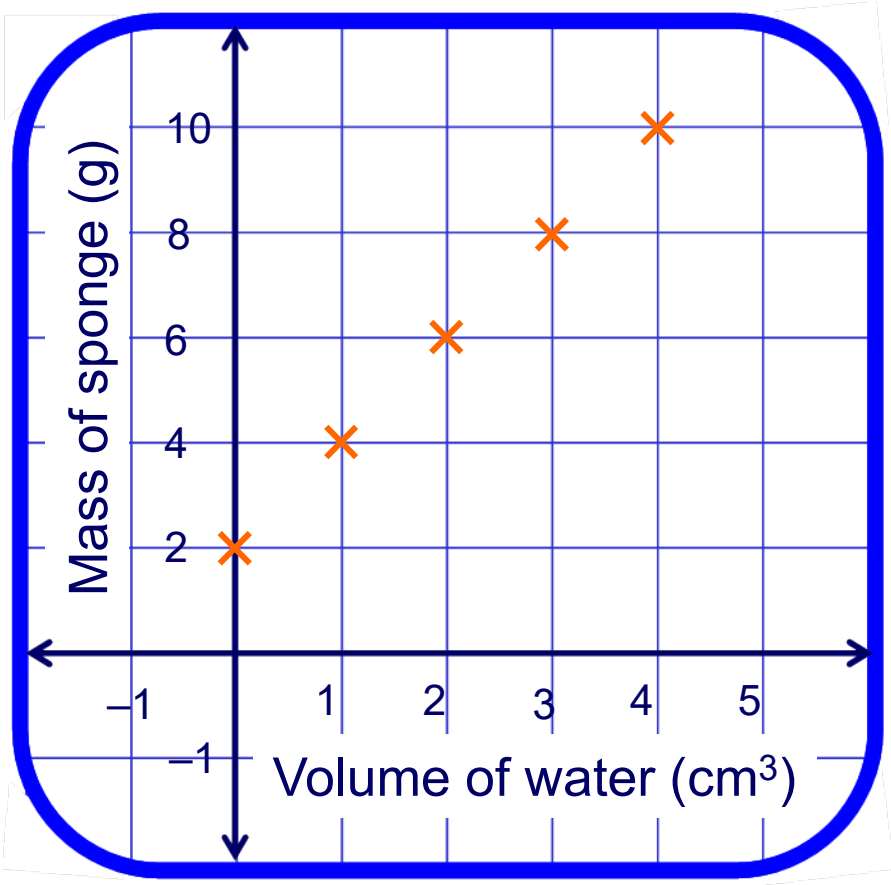
(Hint: this is the y-intercept.)

Mass of dry sponge = 2g

Use the graph to find the ratio of the mass of the sponge to the volume of water.

(Hint: this is the slope of the line.)

Ratio of mass of sponge to volume of water = 2 g/cm³



What is the function for this situation?