3.3 Multiplying by Numbers Less than 1

YOU WILL NEED
- grid paper
- a calculator

GOAL

Multiply by decimals less than 1.

LEARN ABOUT the Math

Yan has a picture that is 80 cm long by 60 cm wide. She is getting a piece of glass cut to cover the picture. She needs to calculate the area of the picture to figure out the price of the glass.

What is the area of the picture in square metres?

A. Draw a model of a square metre on grid paper. Use a 10×10 array of 100 grid squares.

B. What fraction of a square metre does each grid square represent? Write the fraction as a decimal.

C. Represent Yan's picture on your model by colouring grid squares.

D. What is the length of the picture as a fraction of a metre? Write the fraction as a decimal.

E. What is the width of the picture as a fraction of a metre? Write the fraction as a decimal.

F. What expression represents the area of the picture?

G. What is the area of Yan's picture?

Reflecting

H. To determine the area of Yan's picture, you used a 10×10 grid to multiply tenths by tenths. Why does multiplying tenths by tenths always give an answer in hundredths?

I. How is the answer for 0.8×0.6 related to the answer for 8×6?

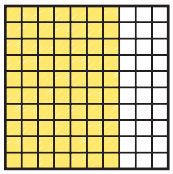
J. How do you know that when you multiply by a decimal less than 1, the product is less than you started with?

WORK WITH the Math

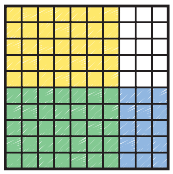
Example 1 | Multiplying using a grid

Calculate the area of a picture in a frame that is 70 cm long by 50 cm wide. Write the area in square metres.

Yan's Solution



Both the length and the width of the grid represent 1 m. I coloured 7 columns to show 0.7 of the grid.



I coloured 5 rows to represent 0.5 of the grid. The area where the blue 0.5 overlaps the yellow 0.7 represents 0.5 of 0.7.

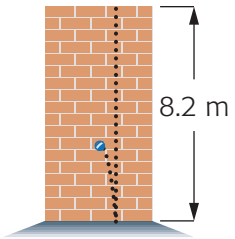
It also represents 0.5×0.7, since it is the area of a 0.5 by 0.7 rectangle. It is 0.35 of the whole grid.

The whole area of the grid represents 1 m^2.

There are 35 squares, so the area is 0.35 m^2.
The area of my frame is 0.35 m^2.

Example 2 | Multiplying thousandths using a calculator

Julie dropped a rubber ball from a height of 8.2 m. Each time the ball bounced, it bounced to 0.355 times its previous height. About how high was the second bounce?



Julie's Solution

8 . 2 [×] 0 . 3 5 5 [=]

The first bounce was 2.911 m high.

To calculate the height of a bounce, I multiplied the height of the previous bounce by 0.355. I used a calculator.

I know that 0.355 × 8.2 should be close to 0.4 × 8.0. That's 3.2, so my calculation is reasonable.

2 . 9 1 1 [×] 0 . 3 5 5 [=]

I multiplied again by 0.355.

1.033 405 is about 1.0.
The second bounce was 1.0 m high.

I expressed my answer to one decimal place, because this is the number of decimal places in the original height.

A Checking

1. Calculate using a 10 × 10 grid.
   a) 0.4 × 0.6 **b)** 0.2 × 0.7

2. Calculate, and then estimate to check if your answer is reasonable.
   a) What is the cost of 0.38 kg of birdseed at $0.95 for each kilogram?
   b) What is the cost of 0.56 kg of rolled oats at $0.88 for each kilogram?

B Practising

3. Calculate.

a) 3.4×0.2 **b)** 7.6×0.8

4. Calculate.

a) 0.2×0.9 **b)** 0.8×0.7

5. Predict the order of these six products from least to greatest. Check your prediction by calculating.

a) 1.3×0.8 **c)** 1.5×0.2 **e)** 5.6×0.2
b) 4.9×0.6 **d)** 10.6×0.3 **f)** 8.4×0.5

6. Place the digits 6, 7, and 8 so that the product is as close to 5 as possible: 0.■ × ▲.◆.

7. In her backyard, Julie has a rabbit run that is 1.2 m long and 0.9 m wide. What is the area of the rabbit run?

8. Joseph Starblanket buys 1.89 kg of beads at $0.85 for each kilogram. Determine how much he pays. Use a calculator.

9. Dora's garden is 2.90 m long and 0.85 m wide. She decides to change her garden so that its length is 1 m less and its width is 1 m greater. What is the change in the area of her garden?

10. Why is it easier to multiply 0.64×0.5 mentally than it is to multiply 0.64×0.7 mentally?

11. Suppose that you multiply 2.34 by a decimal less than 1. What do you know about the answer?