Student Text Page
414

Suggested Timing
75 min

Tools
- grid paper
- computer with graphing software (optional)

Related Resources
- G–1 Grid Paper
- BLM 6–15 Task: Mathematics in Media Studies Rubric

Ongoing Assessment

Use **BLM 6–15 Task: Mathematics in Media Studies Rubric** to assess student achievement.

Mathematics in Media Studies

Teaching Suggestions

- Students should work with a partner to start working on the task.
- Have students investigate the process of repeatedly enlarging and reducing an image by a factor of 50%. Have them use a 10 cm by 15 cm rectangle for this purpose and draw a series of diagrams. Observe students as they work and assist them with this process.
- Once students are comfortable with this process, they may choose to work alone or continue with their partner.
- Have students construct a table of values before they plot the graph of length versus step number. They may find the table useful when they are attempting to find the explicit formula for the terms in this sequence.
- It may be worthwhile to have students discuss their answers to part e). This provides a good opportunity for students to practise mathematical reasoning and to explain their reasoning to others.

Hints for Evaluating a Response

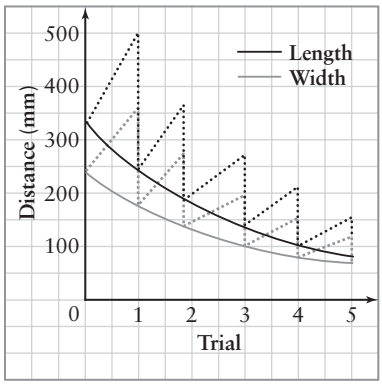
Student responses are being assessed for the level of mathematical understanding they represent. As you assess each response, consider the following questions:

- Does the student recognize the need to complete the calculations for length and then set up a table of values?
- Is the student able to correctly produce a graph of a sequence (discrete function)?
- Has the student developed the ability to find both an explicit and a recursive formula?
- Can the student recognize the type of function in this case?
- Can the student recognize the difference between the two functions in part f) and explain this difference?

Level 3 Sample Response

a)

Number of Times, *N*	Width (mm)	Length (mm)
0	320	240
1	320 + 50% of 320 = 320(1.5) = 480 480 − 50% of 480 = 480(0.5) = 240	240 + 50% of 240 = 240(1.5) = 360 360 − 50% of 360 = 360(0.5) = 180
2	240(1.5) = 360 360(0.5) = 180	180(1.5) = 270 270(0.5) = 135
3	180(1.5) = 270 270(0.5) = 135	135(1.5) = 202.5 202.5(0.5) = 101.25
4	135(1.5) = 202.5 202.5(0.5) = 101.25	101.25(1.5) = 151.875 151.875(0.5) = 75.9375
5	101.25(1.5) = 151.875 151.875(0.5) = 75.94	75.9375(1.5) = 113.906 25 113.906 25(0.5) = 56.96



b) Recursive formula for width:

$f(0) = 320$

$f(n) = f(n - 1) \times 0.75; n \in \mathbb{N}$

Recursive formula for length:

$f(0) = 240$

$f(n) = f(n - 1) \times 0.75; n \in \mathbb{N}$

c) Explicit formula for width:

$f(n) = 320(0.75)^n; n \in \mathbb{W}$

d) width $= f(10)$
$= 320(0.75)^{10}$
$= 18.020\ 324\ 7\ldots$

length $= f(10)$
$= 240(0.75)^{10}$
$= 13.515\ 243\ 53\ldots$

e) No. It is known from exponential functions that the value of $(0.75)^n$ will always have a positive value, never zero, even though the values continue to get smaller, or closer to zero.

f) This is exponential. It is of the form $y = a(b)^x$.

g) Try this again with addition of 10 mm followed by subtraction by 15 mm.

Number of Times, *N*	Width (mm)	Length (mm)
0	320	240
1	320 + 10 = 330 330 − 15 = 315	240 + 10 = 250 250 − 15 = 235
2	315 + 10 − 15 = 310	235 − 5 = 230
3	310 − 5 = 305	230 − 5 = 225
4	305 − 5 = 300	225 − 5 = 220
5	300 − 5 = 295	220 − 5 = 215

Recursive formula for width:

$f(0) = 320$

$f(n) = f(n - 1) - 5; n \in \mathrm{N}$

Recursive formula for length:

$f(0) = 240$

$f(n) = f(n - 1) - 5; n \in \mathrm{N}$

Explicit formula for width:

$f(n) = 320 - 5n; n \in \mathrm{W}$

width $= f(10)$
$= 320 - 5(10)$
$= 270$

length $= f(10)$
$= 240 - 50$
$= 190$

Yes, the dimensions could eventually equal zero.
This is a linear relation of the form $y = a - bx$.

Level 3 Notes

Look for the following:

- In part a), sets up a table of values for the relation and then correctly plots a graph
- Properly labels the graph with the steps along the x-axis
- Determines the correct explicit and recursive formulas to model this relation
- Explains and justifies why the relation is exponential and contrasts that with Calvin's linear model
- Uses correct mathematical form to communicate the information
- Calculations of lengths are organized and clearly shown

What Distinguishes Level 2

- Has some difficulty determining the lengths of the side as they may not completely understand the process of alternately increasing and the decreasing the image
- The graph may be incomplete or incorrectly labelled
- The explicit and/or recursive formulas for this relation are only partially correct
- May not be able to find the terms or the formulas
- May find it difficult to explain why they think the function is exponential, quadratic, and so on
- May have difficulty explaining how the relations are different

What Distinguishes Level 4

- Accurately performs the calculations and produces a table of values that will lead them to the correct graph
- The graphs of a discrete function are well organized and correctly labelled
- Explicit and recursive formulas to model this sequence are developed correctly and written in correct mathematical form
- Correctly identifies the function as exponential and shows a high level of understanding in their justification of their choice
- Recognizes the type of function in part f) and describes effectively the similarities and differences between this function and the one used in the first parts of the task