

**PROJECT MATHS**

**Text & Tests**

**Leaving**

**3**

**Certificate**

# Graphing Functions

## Section 17.7 Graphing exponential functions

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Line:  $ax + b$

Quadratic =  $ax^2 + bx + c$

Cubic =  $ax^3 + bx^2 + cx + d$

Exponential:  $a^x$  The power will be the variable.

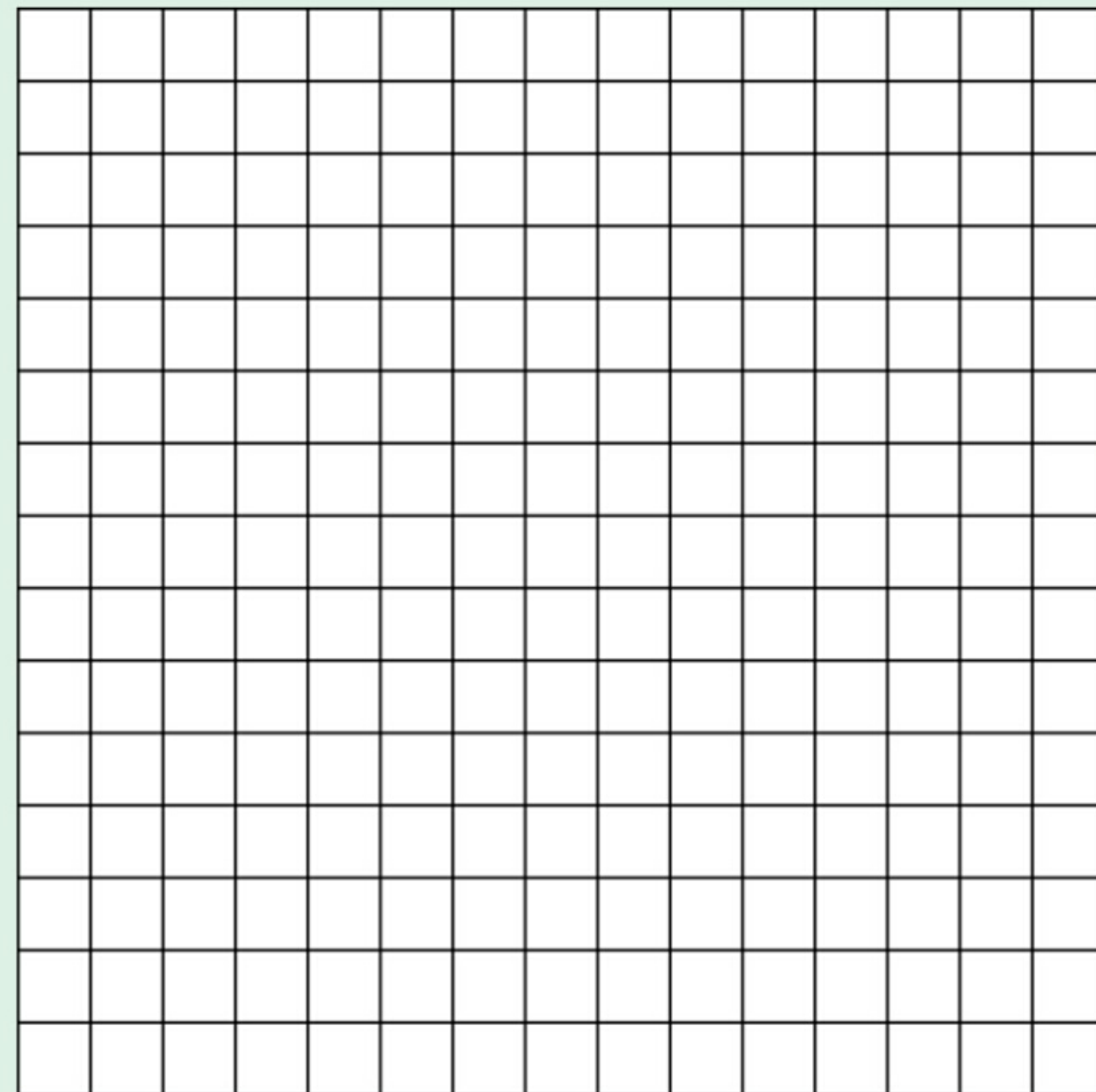
$$f(x) = 2^x$$

Pg 501  
Q1

## Example 1

Draw the graph of the function  $f(x) = 2.3^x$  in the domain  $-2 \leq x \leq 3$ .

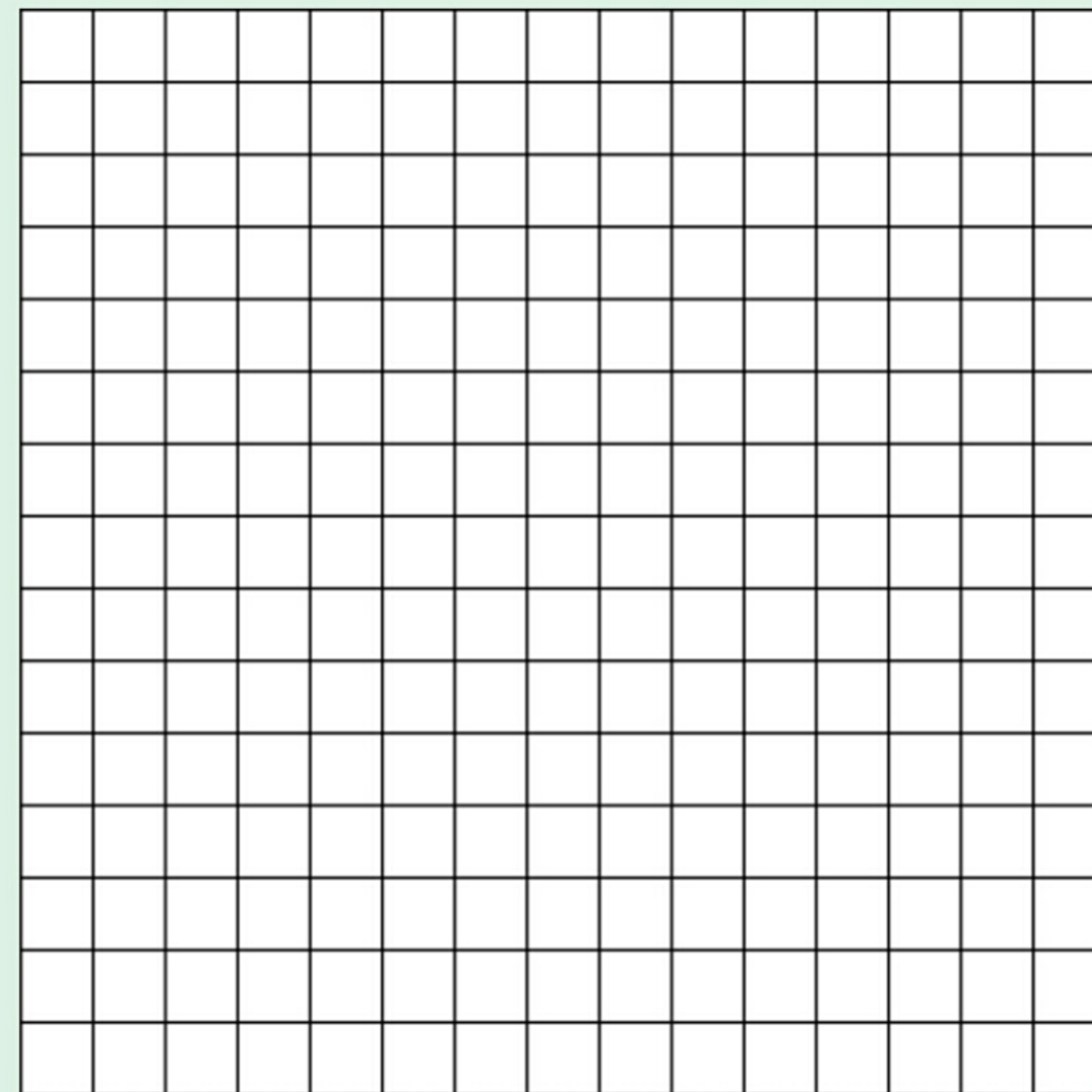
- (i) Use your graph to find an estimate for  $f(2.5)$
- (ii) Use your graph also to find the value of  $x$  for which  $f(x) = 7$ .



## Example 2

Draw the graph of the function  $f(x) = 10 \cdot \left(\frac{1}{2}\right)^x$  in the domain  $0 \leq x \leq 4$ .

- (i) Use your graph to find an estimate of  $f(0.5)$
- (ii) Use your graph to solve the equation  $f(x) = 3$ .



## Exercise 17.7

1. This is the graph of  $f(x) = 2^x$ .

Use the graph to write down

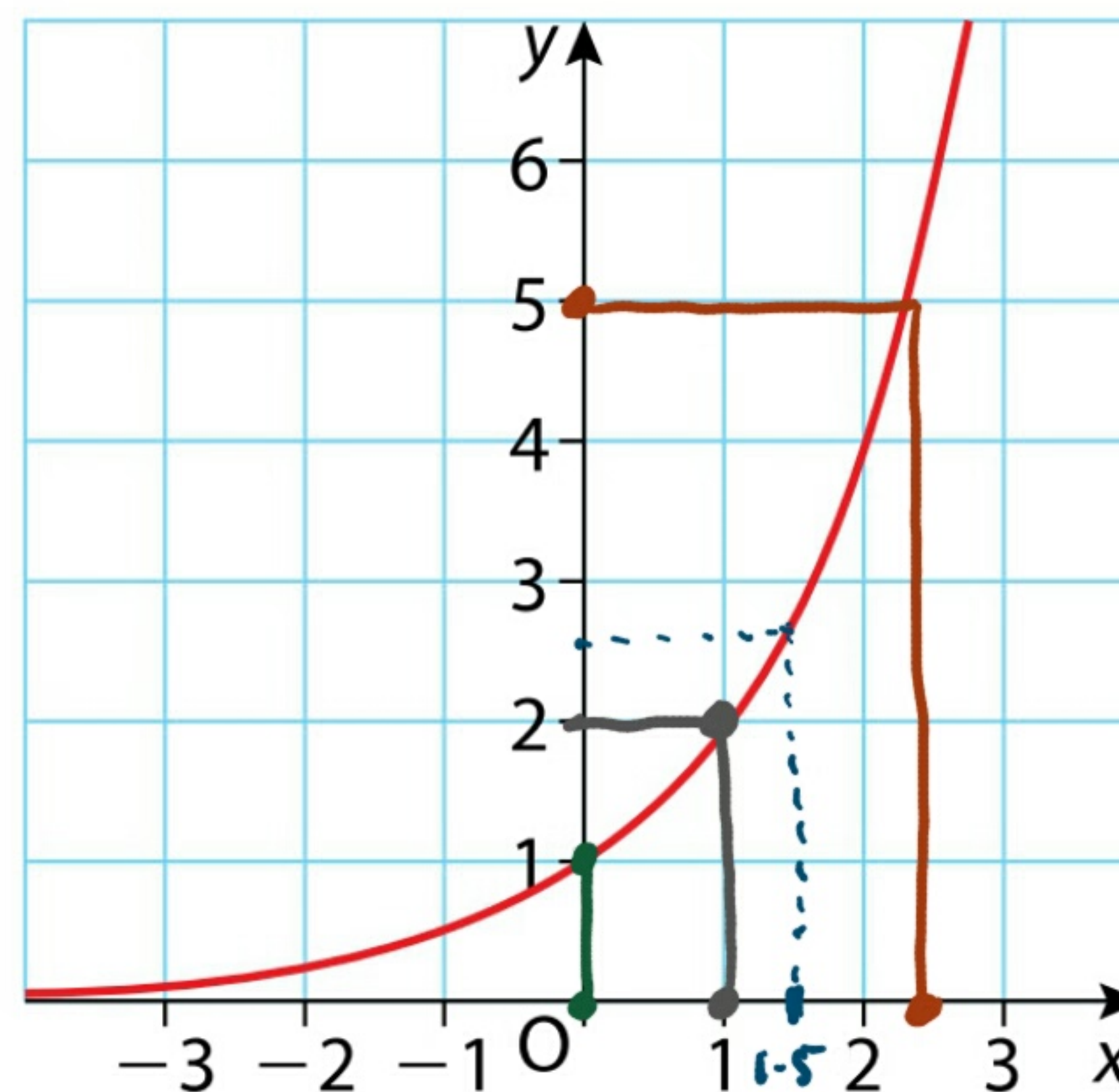
(i)  $f(0) = 1$    (ii)  $f(1) = 2$    (iii)  $f(1.5) = 2.5$

$f(3)$  is not shown on the graph.

(iv) What is  $f(3)$ ?  $2^{(3)} = 2 \times 2 \times 2 = 8$

(v) For what value of  $x$  is  $f(x) = 5$ ?

$$f(2.4) = 5.$$



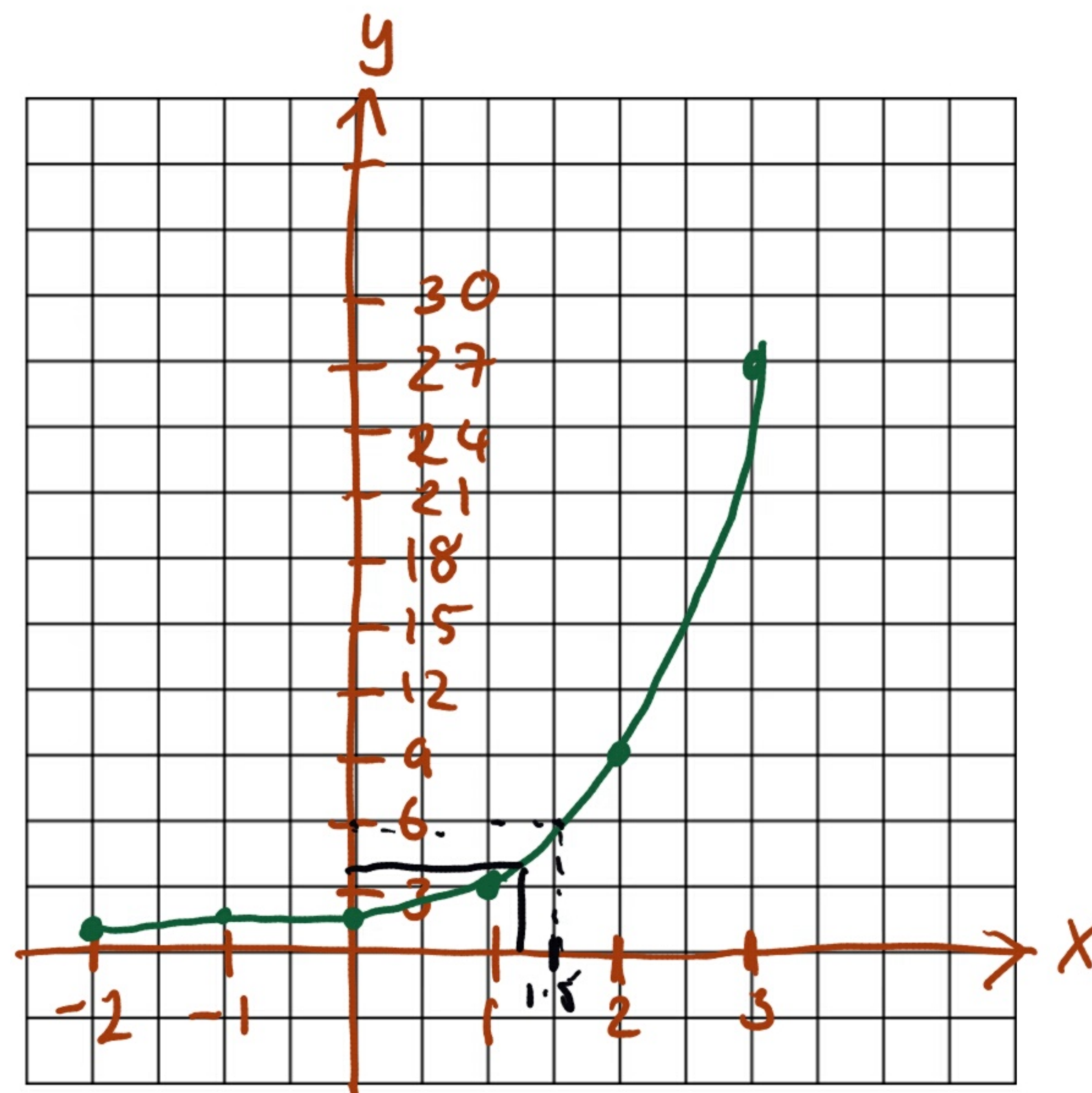
## Exercise 17.7

2. Copy and complete the table below and then draw the graph of the function  $f(x) = 3^x$ .

$x$	-2	-1	0	1	2	3
$3^x$	$\frac{1}{9}$	$\frac{1}{3}$	1	3	9	27

Use your graph to write down

- (i)  $f(1.5) = 6$
- (ii) the value of  $x$  for which  $f(x) = 4$ .
- $f(1.3) = 4$



### Exercise 17.7

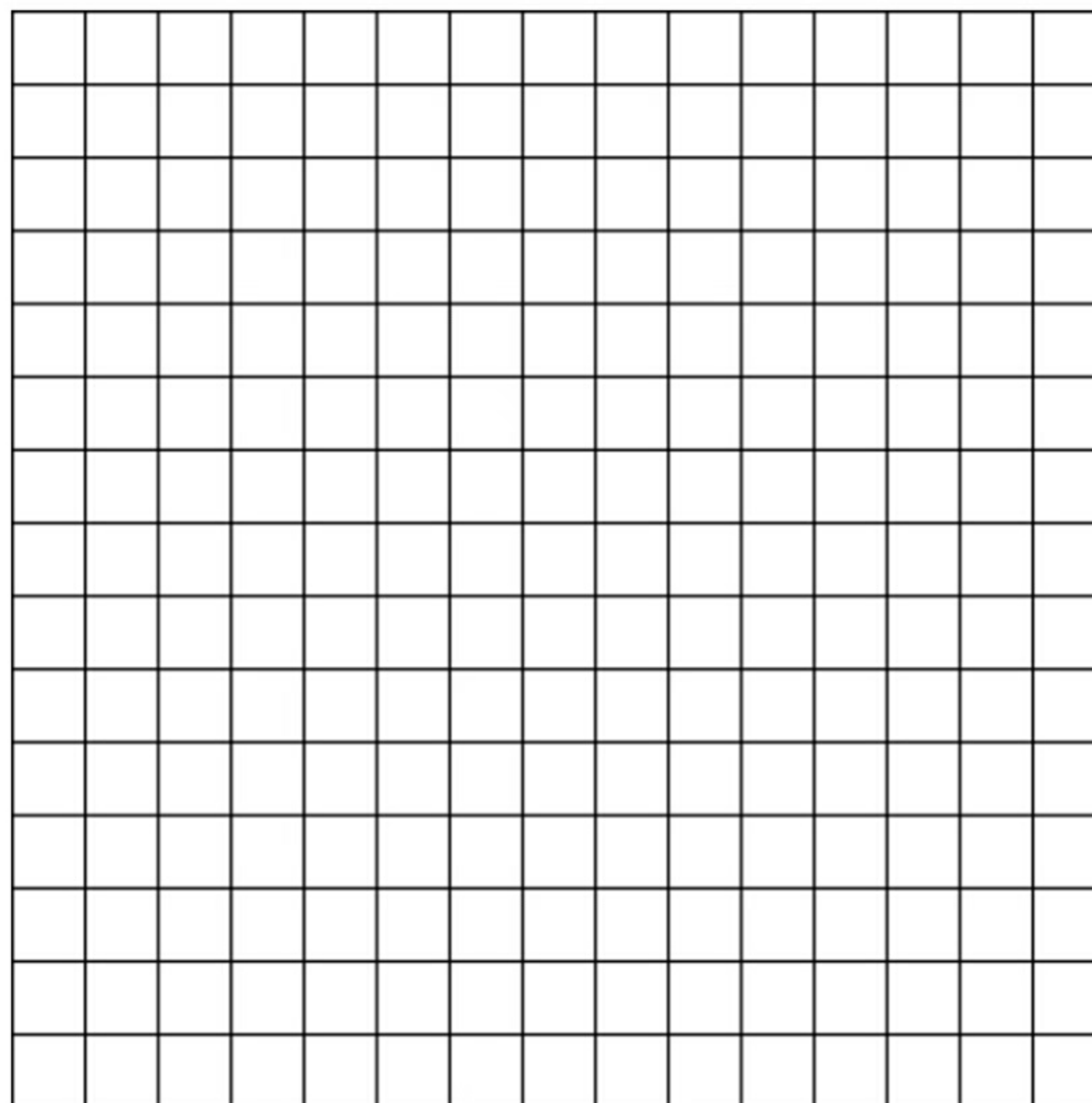
3. Copy and complete the table below.

$x$	-2	-1	0	1	2
$2^x$	$\frac{1}{4}$	0.5	1	2	4
$4(2^x)$	1	2	4	8	16

H(w)

Use the table to draw a sketch of the function  $f(x) = 4 \cdot 2^x$  in the domain  $-2 \leq x \leq 2$ .

Use your graph to find an estimate for  $f(0.5)$ .

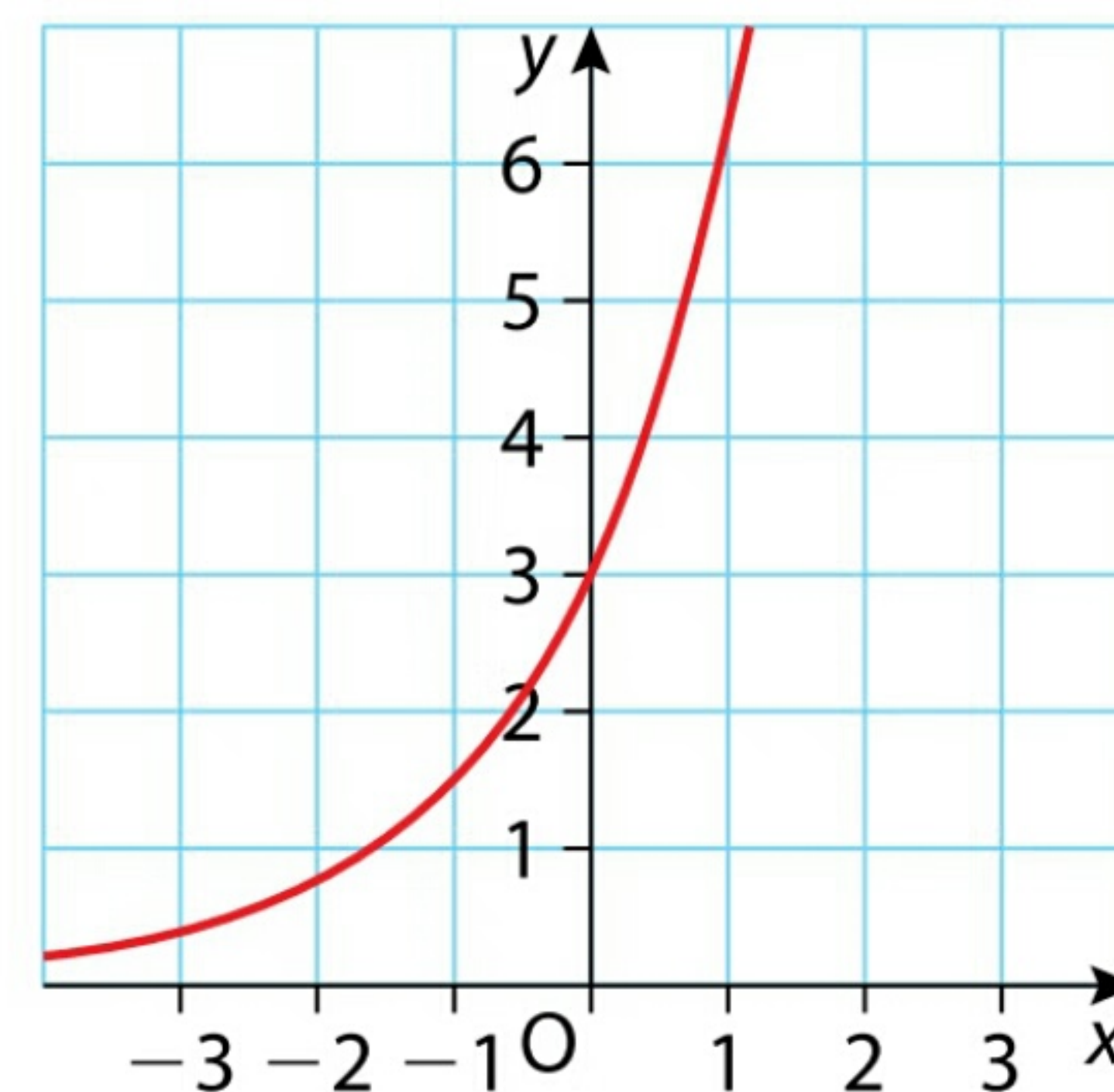


### Exercise 17.7

4. On the right is the graph of  $f(x) = k \cdot 2^x$ , where  $k \in \mathbb{N}$ .

- (i) Write down the value of  $k$ .
- (ii)  $f(2)$  is not shown on the graph.  
What is  $f(2)$ ?
- (iii) Use this graph to estimate the value of  $x$  for which  $f(x) = 1$ .

Hiw.





## Exercise 17.7

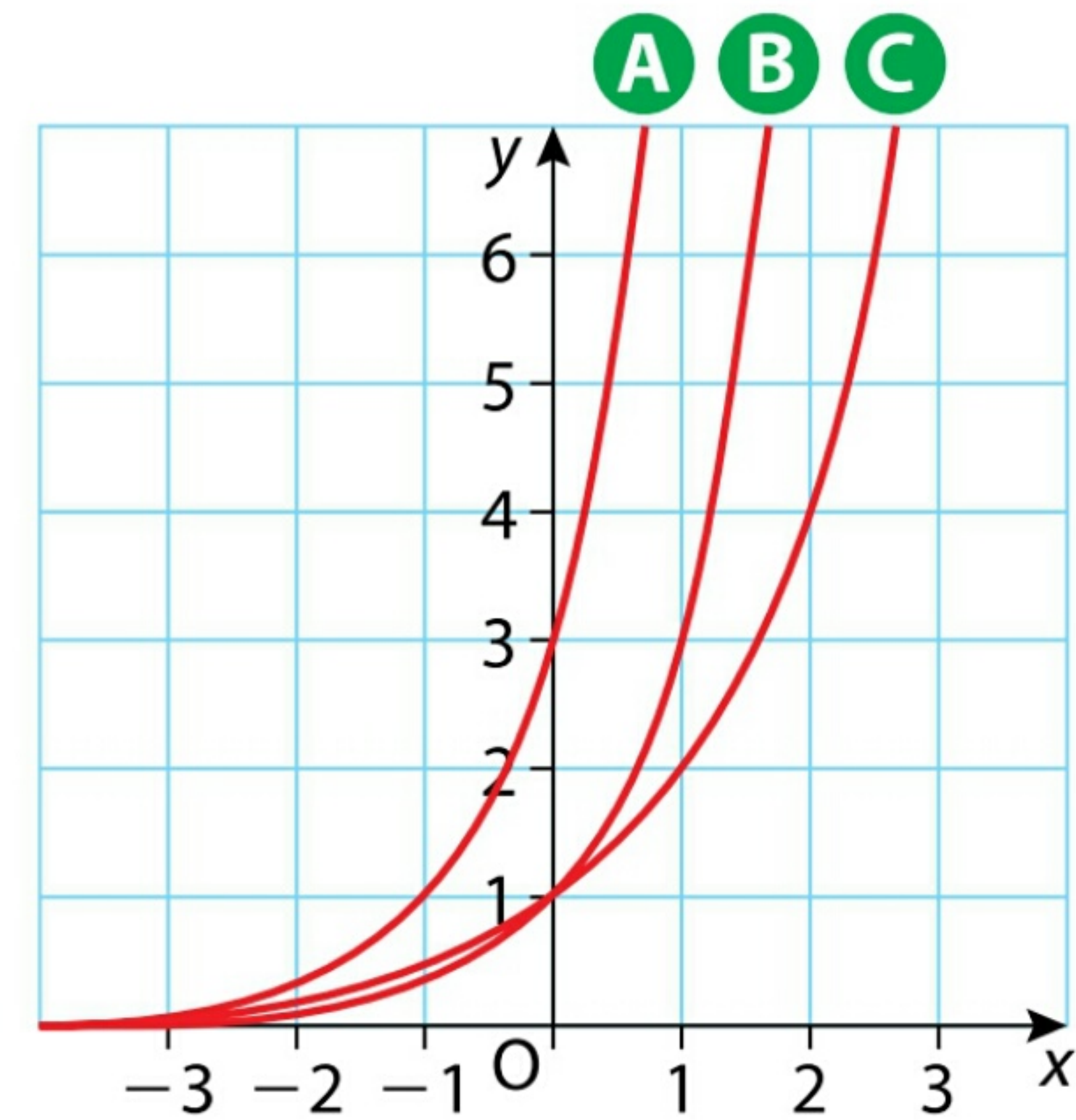
5. Three graphs (A), (B) and (C) are sketched on the right.

Associate each graph with one of the functions given below:

$$f(x) = 2^x$$

$$f(x) = 3^x$$

$$f(x) = 3.3^x$$



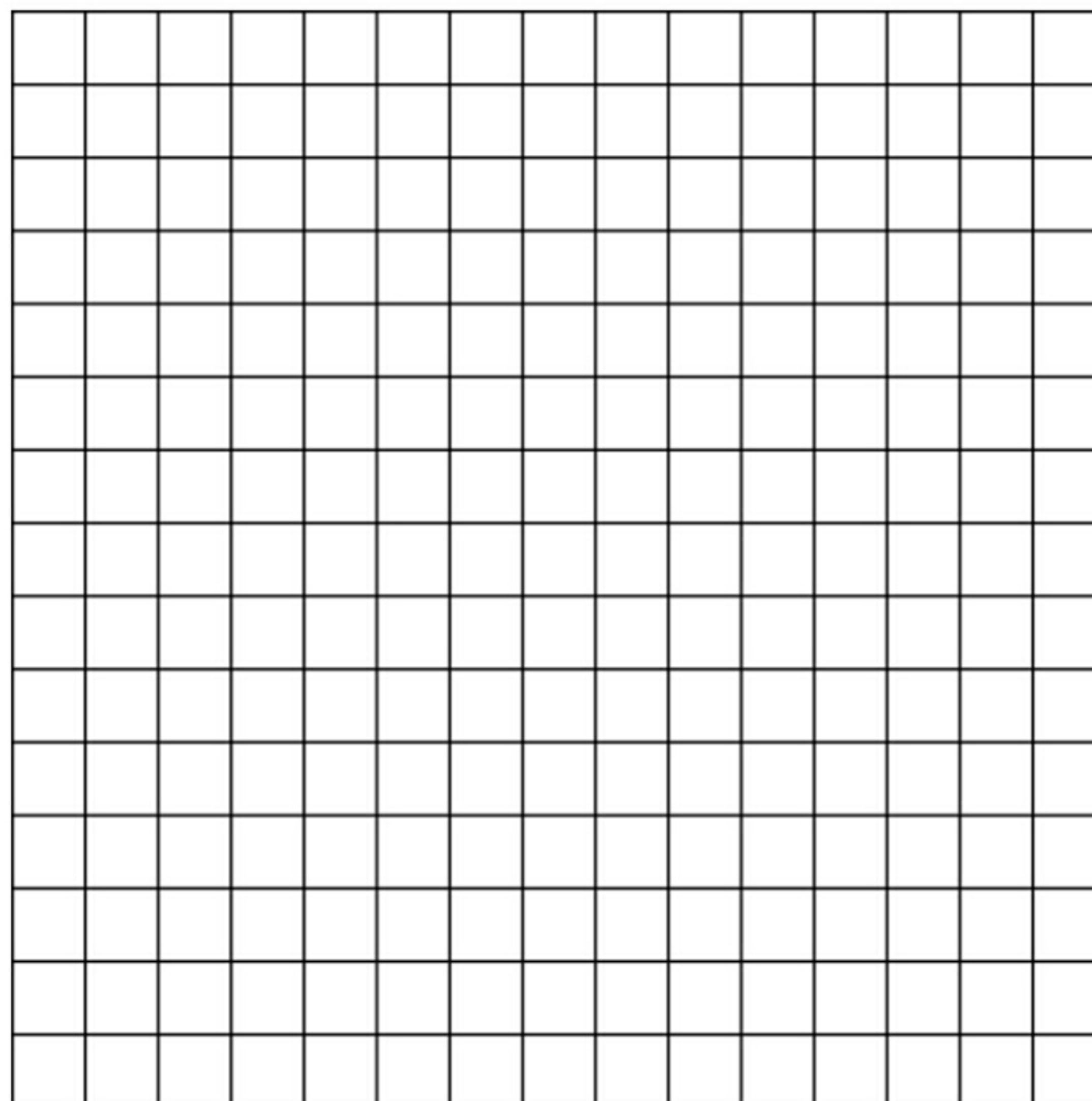
### Exercise 17.7

6. Copy and complete the table below and hence draw the graph of the function  $f(x) = 3^{-x}$  in the domain  $-2 \leq x \leq 3$ .

$x$	-2	-1	0	1	2	3
$f(x) = 3^{-x}$						

Use your graph to estimate

- (i)  $f(-1.5)$       (ii) the value of  $x$  when  $f(x) = 4$ .

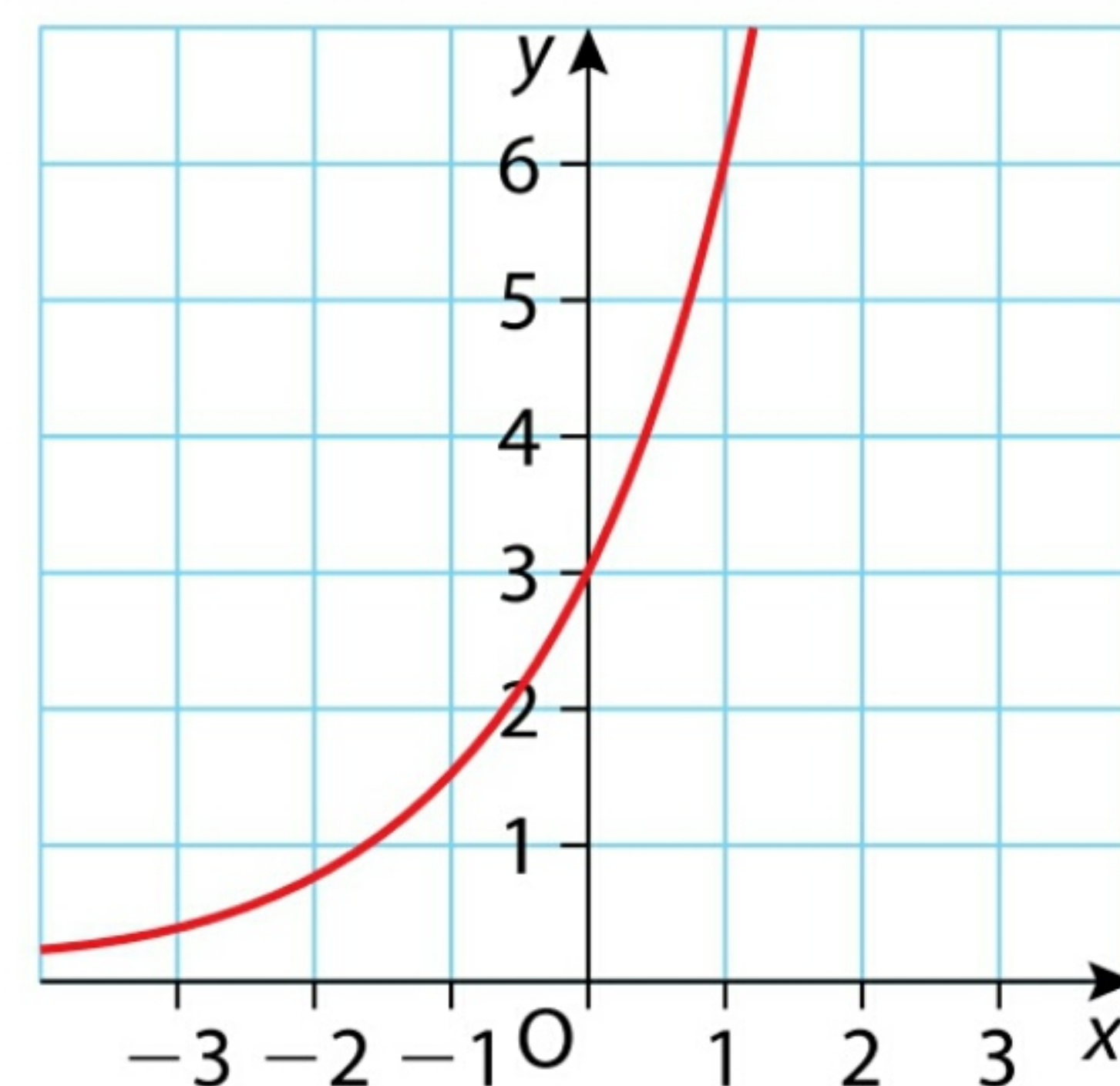


### Exercise 17.7

7. Graphed on the right is the function  $f(x) = a \cdot b^x$ .

Copy and complete the table below and use the table and the graph to find the values of  $a$  and  $b$ .

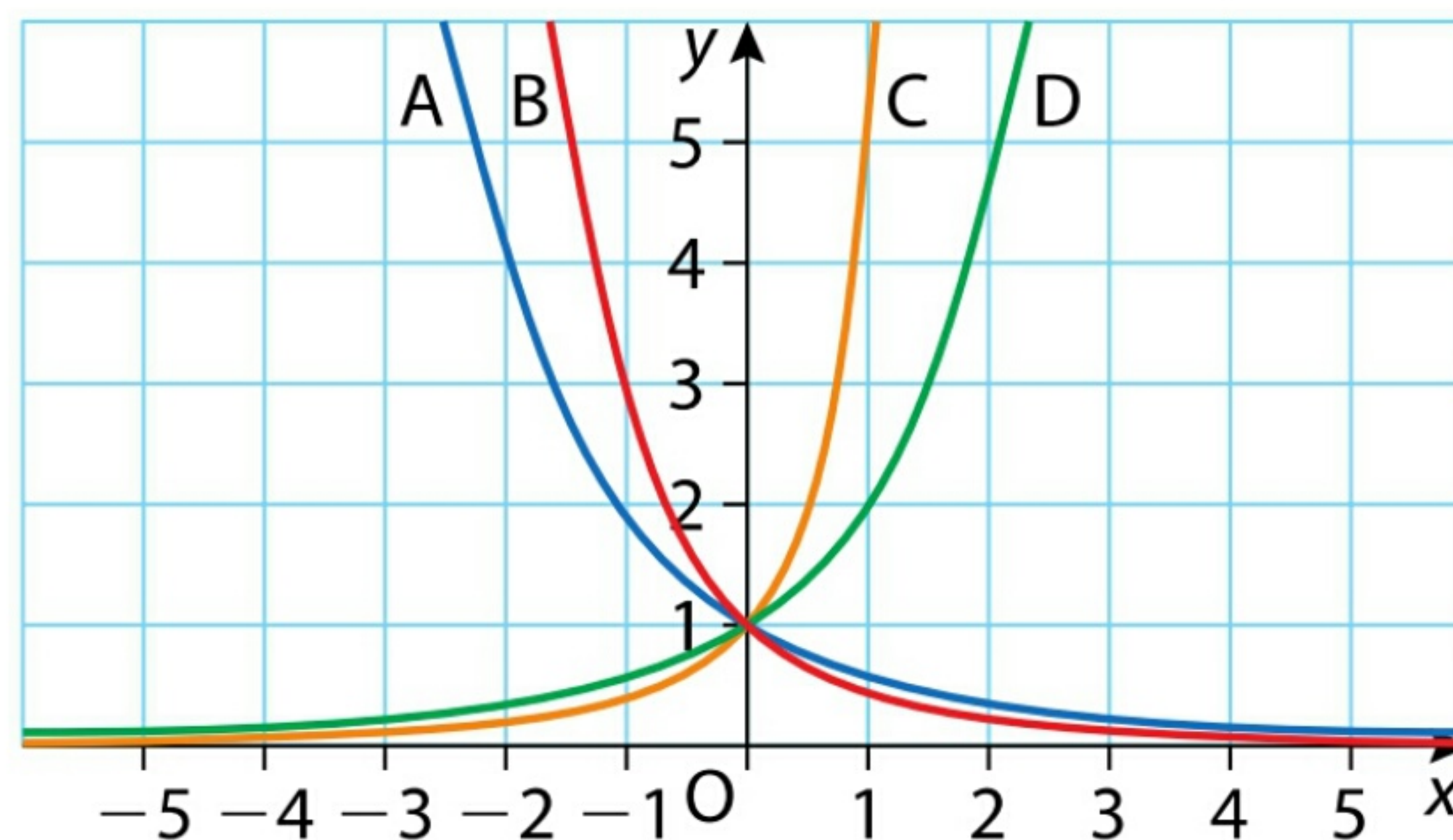
$x$	$f(x) = a \cdot b^x$	$y$
0		
1		



### Exercise 17.7

8. The diagram below shows the graphs of

$$y = 2^x, y = 5^x, y = \left(\frac{1}{2}\right)^x \text{ and } y = 3^{-x}.$$



Use different values for  $x$  and the corresponding  $y$ -values to match each graph to its equation.

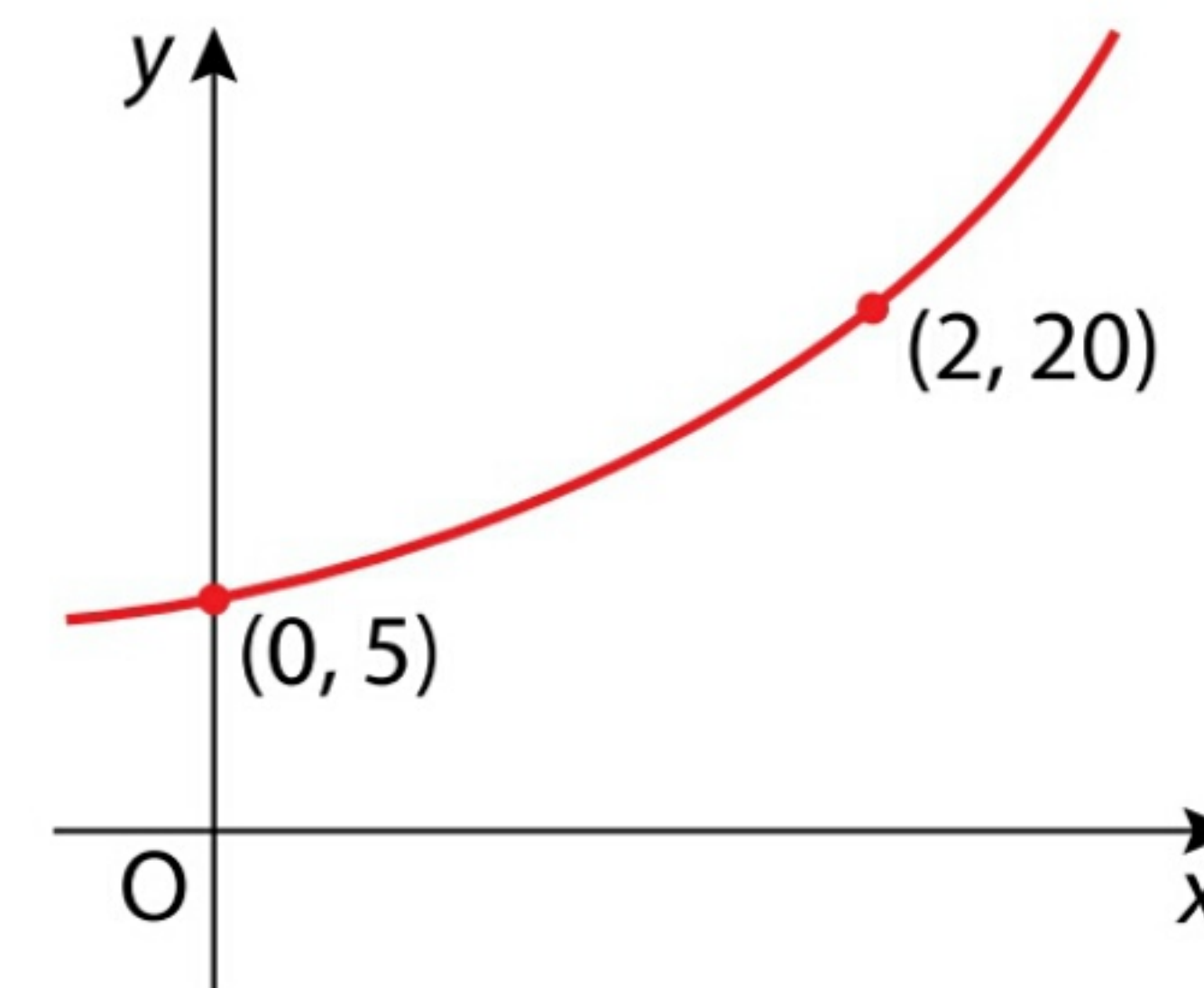
### Exercise 17.7

9. Anto is told that the given curve is the graph of either

(a)  $f(x) = k \cdot 2^x$  or (b)  $f(x) = k \cdot 3^x$ .

(i) Find the value of  $k$ .

(ii) Write down which of the two functions the curve represents.



### Exercise 17.7

**10.** The curve  $y = a(2^x)$  passes through the point  $(1, 3)$ .

Find the value of  $a$ .

### Exercise 17.7

**11.** The curve  $y = a(b^x)$  passes through the points  $(1, 10)$  and  $(3, 250)$ .

Find the value of  $a$  and the value of  $b$ .

### Exercise 17.7

**12.**  $f: x \rightarrow 2x + 3$ ,  $g: x \rightarrow x^2 + 3$ , and  $h: x \rightarrow 3(2^x)$  are three functions.

Table A

$x$	$y$
0	3
1	6
2	12
3	24
4	48

Table B

$x$	$y$
0	3
1	5
2	7
3	9
4	11

Table C

$x$	$y$
0	3
1	4
2	7
3	12
4	19

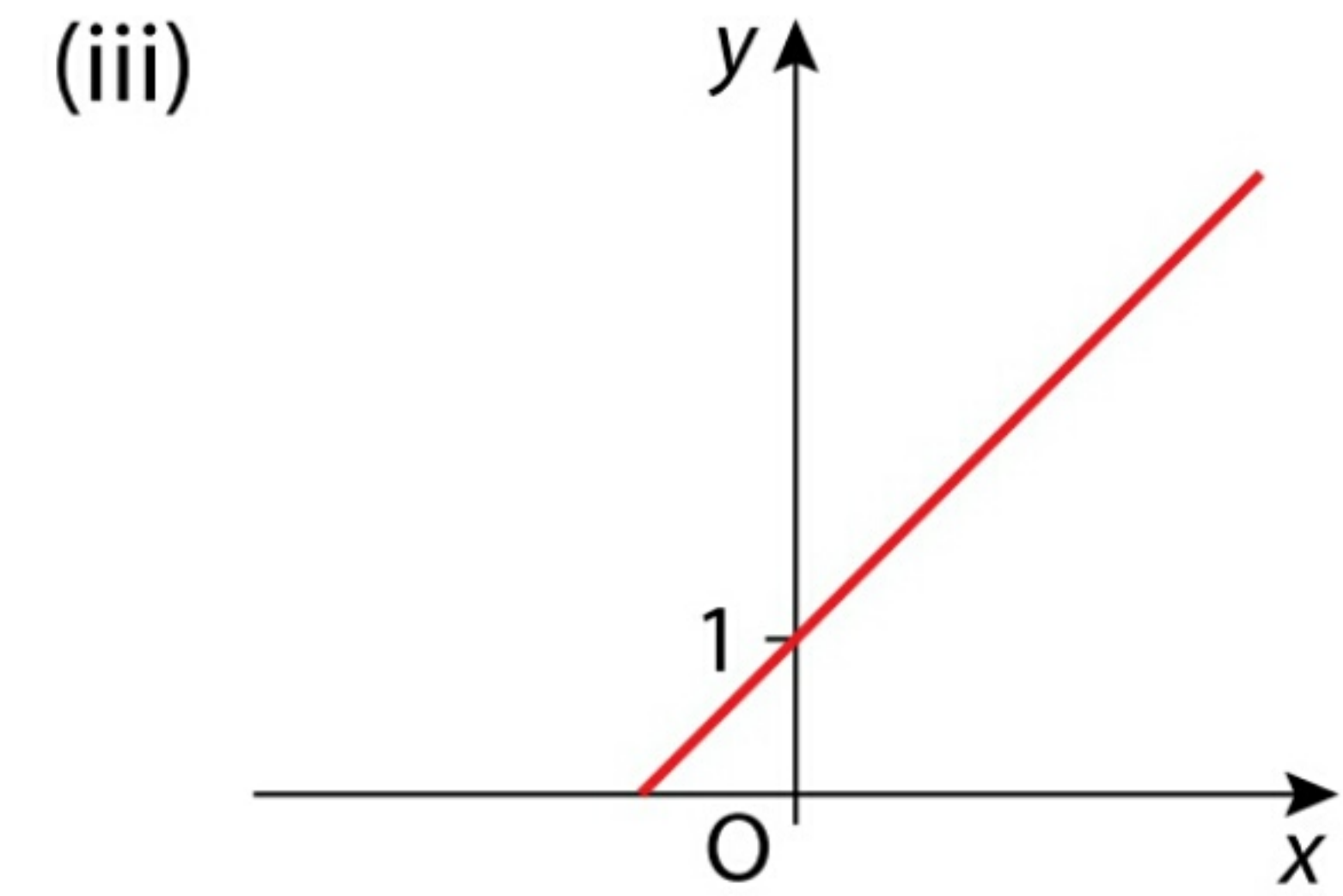
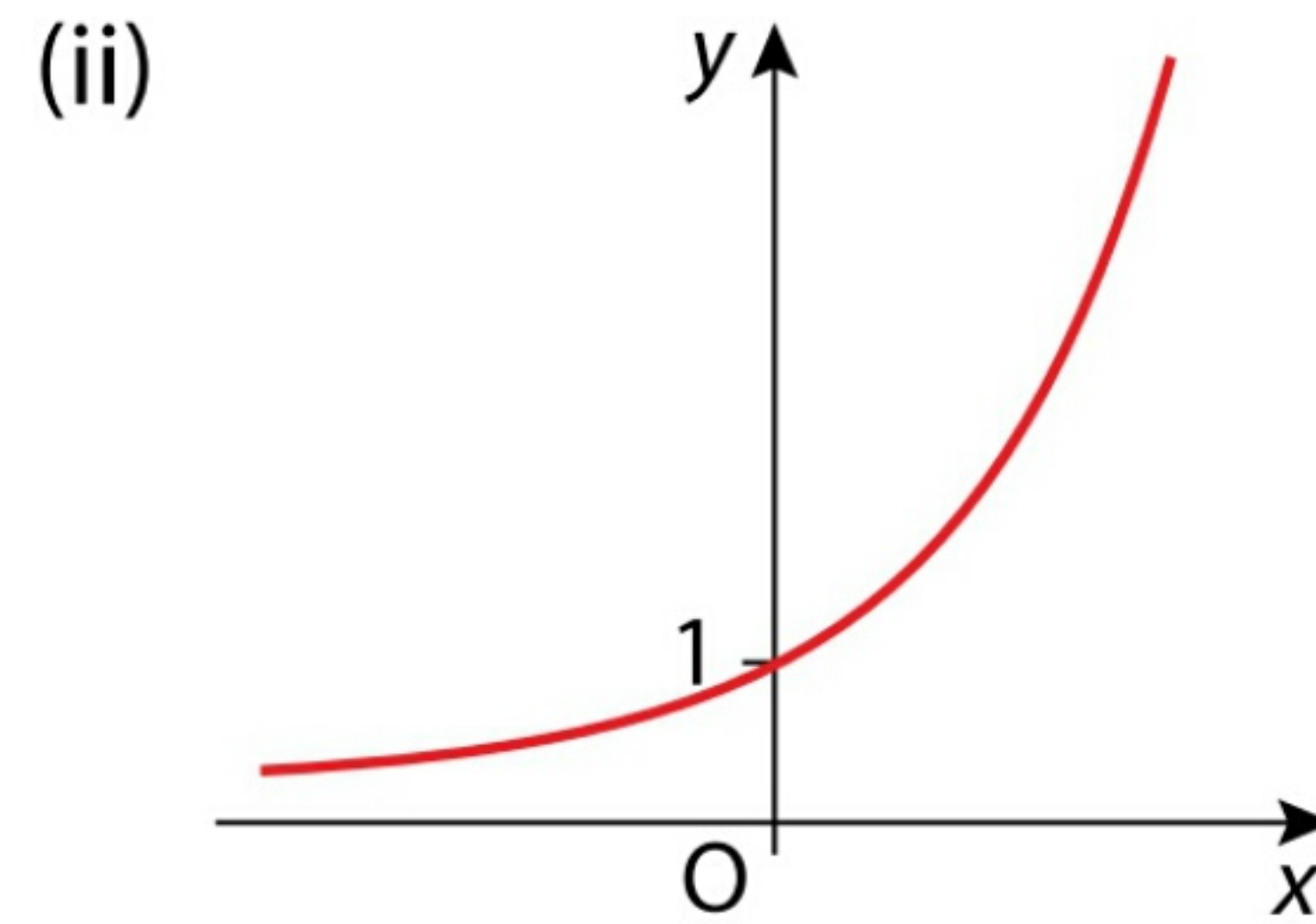
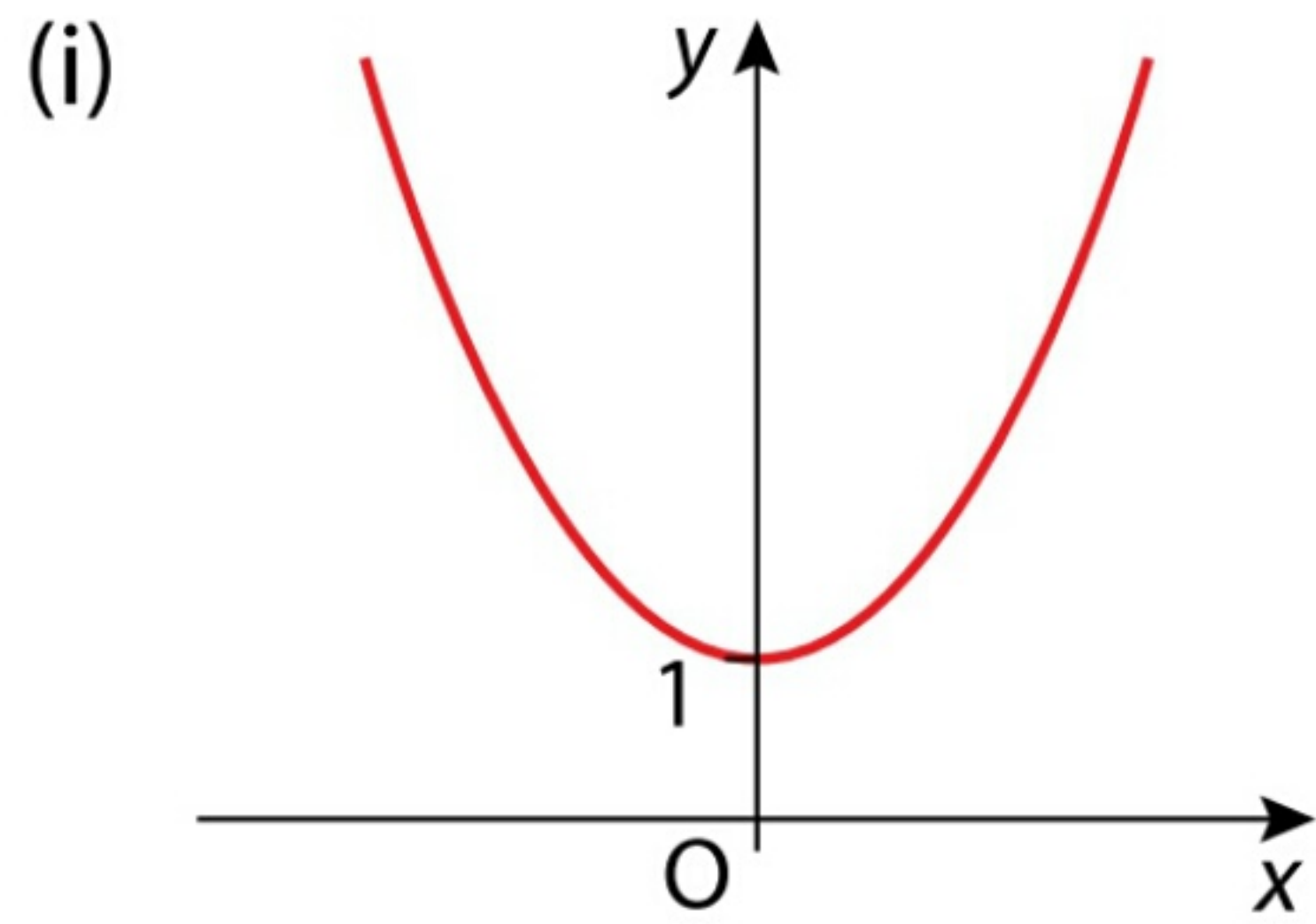
- Match the table of outputs with the correct function.
- Which function is increasing at the quickest rate?



### Exercise 17.7

**13.** A:  $y = 2^x$  ; B:  $y = 2x + 1$  ; C:  $y = x^2 + 1$  are three functions.

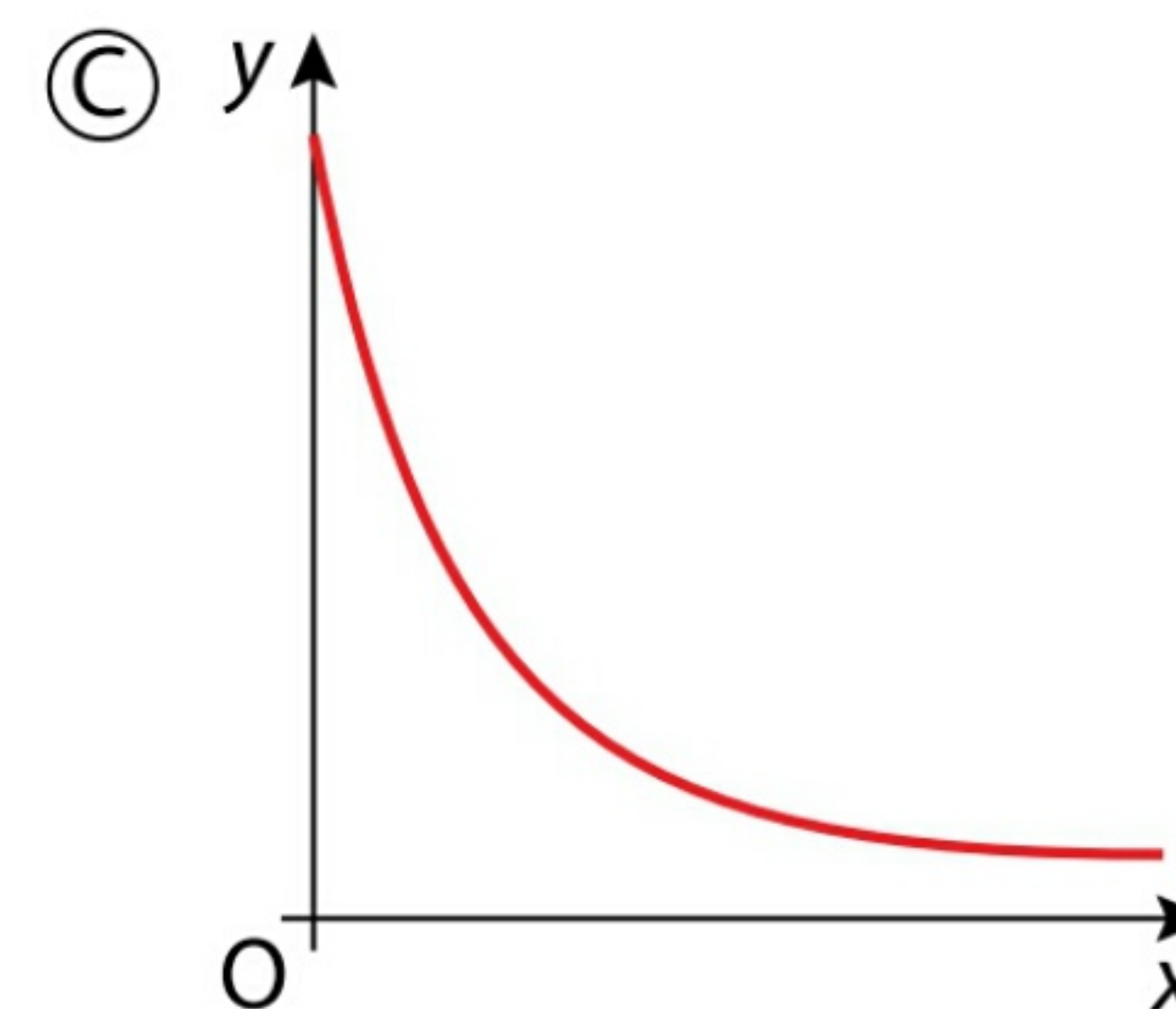
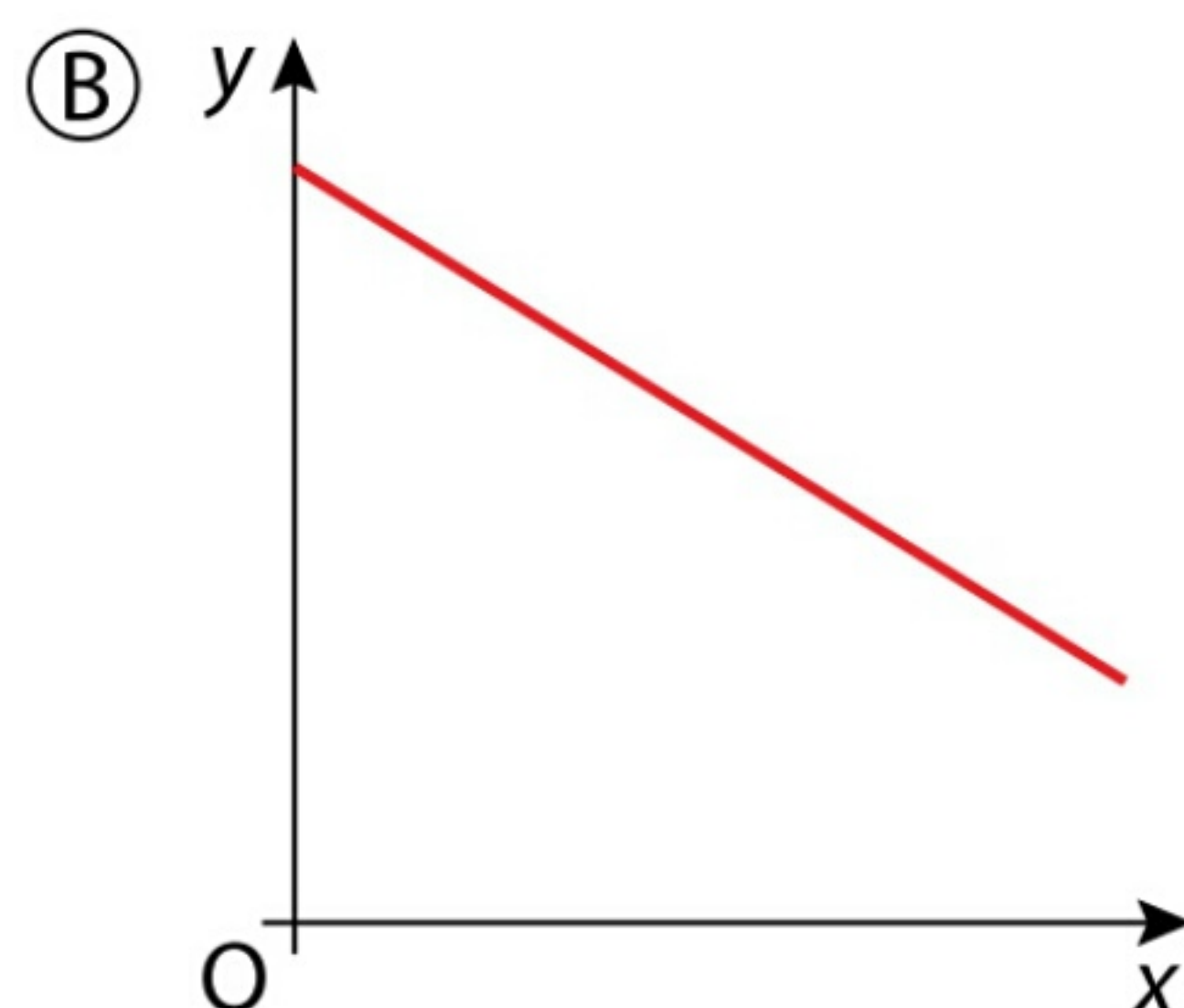
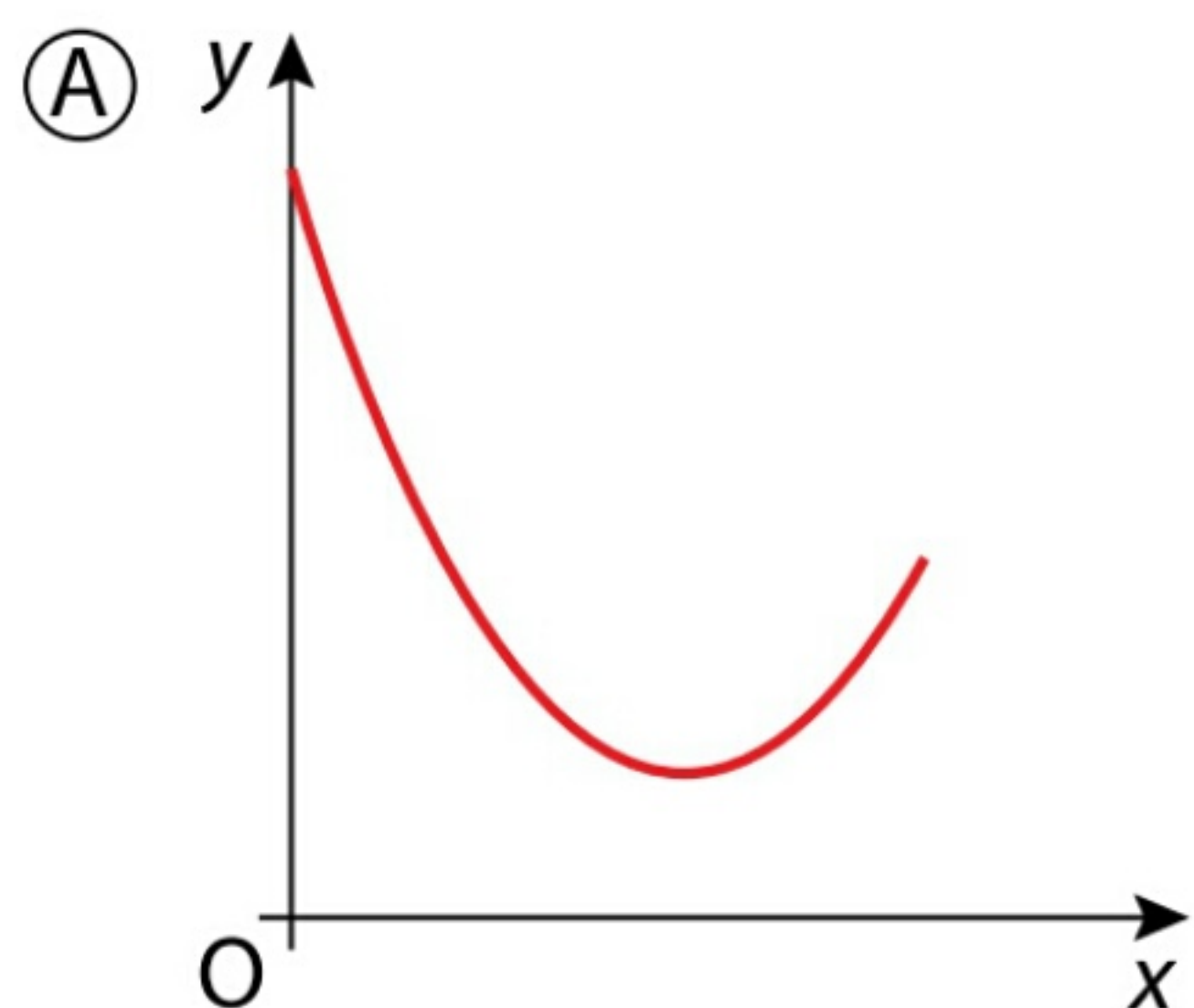
Match each graph below to its function.



## Exercise 17.7

14. Here are three statements and three graphs:

- (i) A car worth €60 000 decreases in value by €10 000 each year.
- (ii) Property prices have fallen in value by 10% each year for the past four years.
- (iii) A bungee jumper jumps off a bridge and her height above the ground is recorded every second.



Match each statement with its graph and explain your answer in each case.

### Exercise 17.7

**15.** The functions  $f$  and  $g$  are defined as follows:

$$f: x \rightarrow 3^x \text{ and } g: x \rightarrow 4x^2 + 1 \text{ in the domain } 0 \leq x \leq 5.$$

- (i) What type of function is  $f$ ?
- (ii) What type of function is  $g$ ?
- (iii) Which function is increasing at the faster rate between  $x = 0$  and  $x = 3$ ?
- (iv) Which function is increasing faster between  $x = 3$  and  $x = 5$ ?

## Exercise 17.7

**16.** Two functions  $f$  and  $g$  are defined as follows:

$$f: x \rightarrow 2^x, \quad g: x \rightarrow 9x - 3x^2 - 1.$$

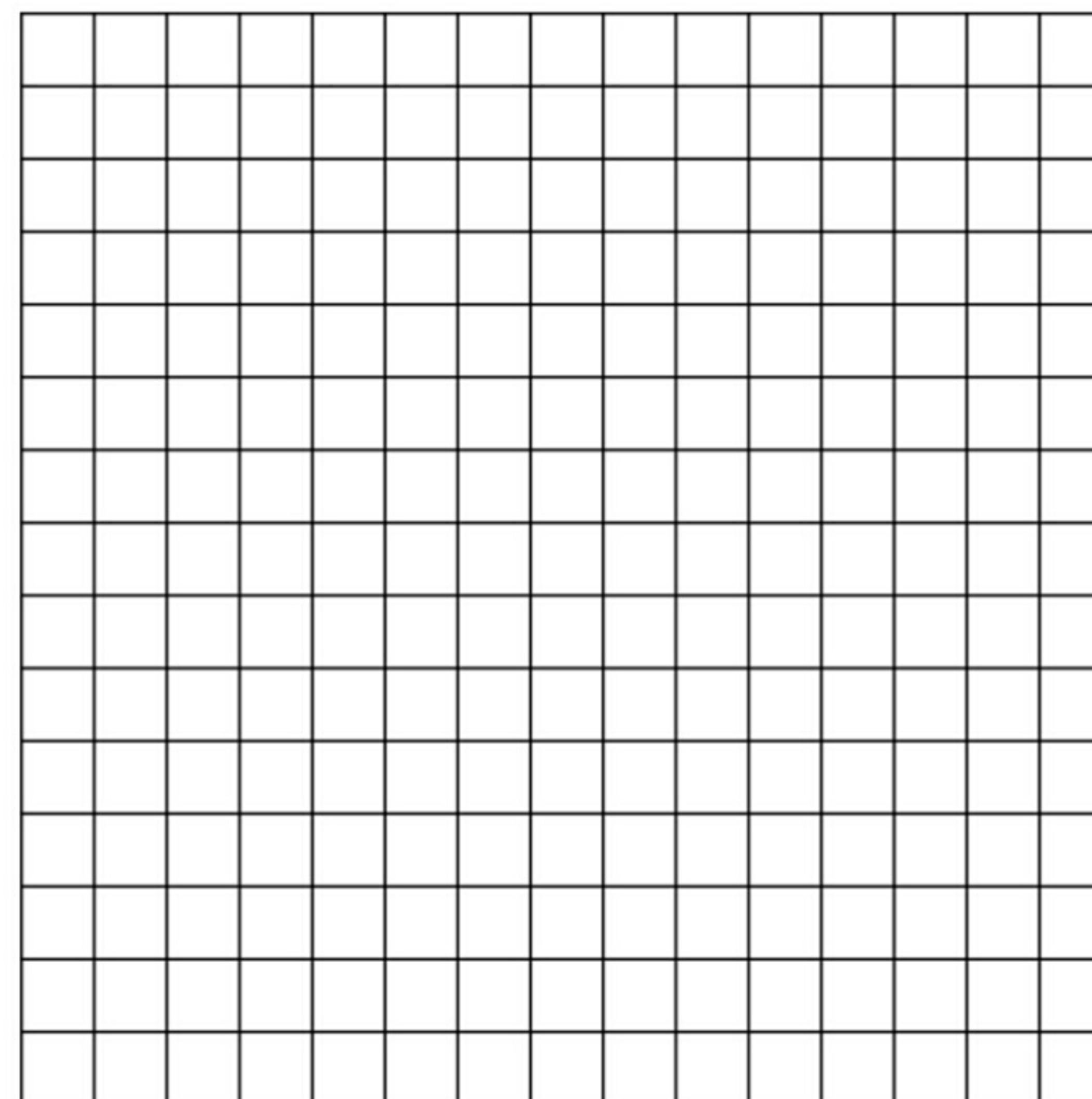
Complete the table below and use it to draw the graphs of  $f$  and  $g$  for  $0 \leq x \leq 3$ .

$x$	0	0.5	1	1.5	2	2.5	3
$f(x)$							
$g(x)$							

(i) Use your graph to estimate the value(s) of  $x$  for which

$$2^x = 9x - 3x^2 - 1.$$

(ii) If  $2^k = 6$ , use your graph to estimate the value of  $k$ .



## Answers 17.7

1. (i) 1                      (ii) 2                      (iii) 2.8  
       (iv) 8                     (v) 2.3
2.  $(-2, \frac{1}{9}), (-1, \frac{1}{3}), (0, 1), (1, 3), (2, 9), (3, 27)$ ;  
       (i) 5.2                      (ii) 1.3
3. 

<b>x</b>	-2	-1	0	1	2
<b>2<sup>x</sup></b>	$\frac{1}{4}$	$\frac{1}{2}$	1	2	4
<b>4.2<sup>x</sup></b>	1	2	4	8	16

 ; 5.7
4. (i)  $k = 3$                       (ii) 12                      (iii) -1.6
5.  $A: f(x) = 3.3^x$ ;  $B: f(x) = 3^x$ ;  $C: f(x) = 2^x$
6.  $(-2, 9), (-1, 3), (0, 1), (1, \frac{1}{3}), (2, \frac{1}{9}), (3, \frac{1}{27})$ ;  
       (i) 5.2  
       (ii) -1.3
7.  $a = 3, b = 2$
8.  $A: y = (\frac{1}{2})^x$ ;  $B: y = 3^{-x}$ ;  $C: y = 5^x$ ;  $D: y = 2^x$
9. (i)  $k = 5$                       (ii)  $f(x) = k.2^x$
10.  $a = 1.5$
11.  $a = 2, b = 5$

## Answers 17.7

- 12.** (i) Table A:  $h:x \rightarrow 3(2^x)$ ;  
Table B:  $f:x \rightarrow 2x + 3$ ;  
Table C:  $g:x \rightarrow x^2 + 3$   
(ii)  $h:x \rightarrow 3 \cdot (2^x)$
- 13.** A and (ii); B and (iii), C and (i)
- 14.** A = (iii); height will decrease, then increase  
B = (i); decrease by the same amount each year  
C = (ii); decrease by different amounts each year
- 15.** (i) Exponential  
(ii) Quadratic  
(iii)  $g:x \rightarrow 4x^2 + 1$   
(iv)  $f: x \rightarrow 3^x$

**16.**

<b><math>x</math></b>	0	0.5	1	1.5	2	2.5	3
<b><math>2^x</math></b>	1	1.4	2	2.8	4	5.7	8
<b><math>9x - 3x^2 - 1</math></b>	-1	2.75	5	5.75	5	2.75	-1

- (i) 0.275, 2.15  
(ii) 2.6