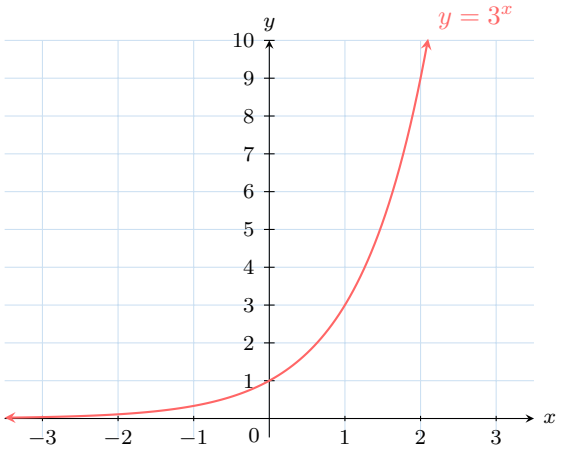
EXPONENTIAL FUNCTIONS

A EXPONENTIAL FUNCTION

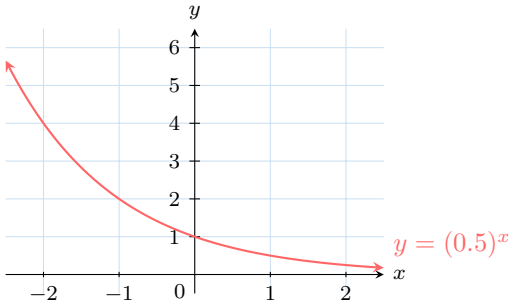
A.1 READING AND SKETCHING EXPONENTIAL FUNCTIONS

Ex 1: Find an approximation to the nearest integer, by reading the value from the graph of $f(x) = 3^x$:



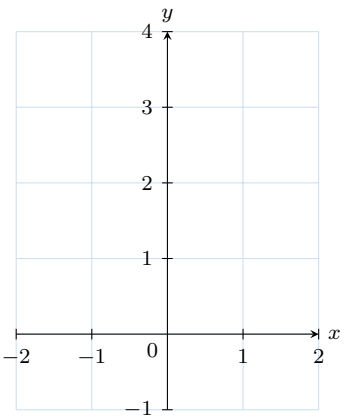
1. $\square \leq 3^{1.5} < \square$
2. $\square \leq 3^{0.5} < \square$

Ex 2: Find an approximation to the nearest integer, by reading the value from the graph of $f(x) = (0.5)^x$:

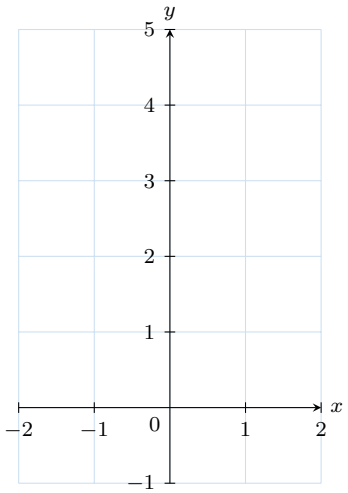


1. $\square \leq (0.5)^{-0.5} < \square$
2. $\square \leq (0.5)^{-1.5} < \square$

Ex 3: For the function $f(x) = 2^x$, sketch the graph of f.(You may fill in a table of values for $x = -2, -1, 0, 1, 2$.)



Ex 4: For the function $f(x) = \left(\frac{1}{2}\right)^x$, sketch the graph of f.(You may fill in a table of values for $x = -2, -1, 0, 1, 2$.)



A.2 EVALUATING EXPONENTIAL FUNCTIONS

Ex 5: For $f(x) = 3^x$, evaluate:

1. $f(2) = \square$
2. $f(0) = \square$
3. $f(-1) = \square$

Ex 6: For $f(x) = 10^x$, evaluate:

1. $f(2) = \square$
2. $f(0) = \square$
3. $f(-1) = \square$

Ex 7: For $f(x) = \left(\frac{1}{2}\right)^x$, evaluate:

1. $f(-2) = \square$
2. $f(-1) = \square$
3. $f(0) = \square$
4. $f(1) = \square$

B EXPONENTIAL VS. LINEAR RELATIONSHIPS

B.1 RECOGNIZING LINEAR, EXPONENTIAL, OR NEITHER RELATIONSHIPS FROM TABLES

MCQ 8:

x	0	1	2	3
y	1	5	25	125

What is the relationship between the two variables?

☐ linear relationship

☐ exponential relationship

☐ neither

MCQ 9:

x	0	1	2	3
y	0	20	40	60

What is the relationship between the two variables?

☐ linear relationship

☐ exponential relationship

☐ neither

MCQ 10:

x	0	2	4	6
y	1	6	11	16

What is the relationship between the two variables?

☐ linear relationship

☐ exponential relationship

☐ neither

MCQ 11:

x	0	1	2	3
y	3	6	12	24

What is the relationship between the two variables?

☐ linear relationship

☐ exponential relationship

☐ neither

MCQ 12:

x	0	1	2	3
y	2	5	10	17

What is the relationship between the two variables?

☐ linear relationship

☐ exponential relationship

☐ neither

B.2 RECOGNIZING LINEAR AND EXPONENTIAL RELATIONSHIPS IN REAL-LIFE CONTEXTS

MCQ 13: The number of infected people with Covid doubles each day. What is the relationship between the two variables (day and number of infected)?

☐ linear relationship

☐ exponential relationship

☐ neither

MCQ 14: A bus ticket costs \$2, plus an extra \$0.50 for each additional zone crossed. What is the relationship between the number of zones crossed and the total price?

☐ linear relationship

☐ exponential relationship

☐ neither

MCQ 15: The amount of money in a bank account increases by 5% each year due to compounded interest. What is the relationship between the two variables (year and amount)?

☐ linear relationship

☐ exponential relationship

☐ neither

MCQ 16: A cyclist travels at a constant speed of 15 km per hour. What is the relationship between the number of hours and the distance traveled?

☐ linear relationship

☐ exponential relationship

☐ neither

C EXPONENTIAL MODELS

C.1 MODELING REAL-WORLD SITUATIONS WITH EXPONENTIAL FUNCTIONS

Ex 17: A population of bacteria doubles every second. At time $x = 0$, there is a single bacterium.
Find the function to model this growth.

$$P(x) = \square$$

Ex 18:  A species of bear is introduced to a large island off Alaska where previously there were no bears. 6 pairs of bears were introduced in 1998. It is expected that the population will increase according to $B(t) = B_0 \times (1.13)^t$ where t is the time, in years, since the introduction.

1. Find B_0.

   $\square$ bears

2. Find the expected bear population in 2018.

$\square$ bear (round to the nearest integer)

3. Find the expected percentage increase in population from 1998 to 2018.

$\square$% (round to the nearest integer)

Ex 19: Sarah buys a piece of artwork for \$1500 that is expected to appreciate (increase in value) by 8% each year.

1. Determine a model for A_n, the value of the artwork after n years.

$A_n =$ $\square$

2. Is this an example of exponential growth?
   ☐ Yes
   ☐ No

3. Calculate the estimated value of the artwork in 6 years' time.

\$ $\square$ (round to the nearest integer)

Ex 20: Maxime has an Uncle Scrooge coin worth \$500. Each year, the coin's value increases by 20%.

1. Determine a model for C_n, the value of the coin after n years.

$C_n =$ $\square$

2. Is this an example of exponential growth?
   ☐ Yes
   ☐ No

3. Calculate the estimated value of the coin in 6 years' time.

\$ $\square$ (round to the nearest integer)

Ex 21: A certain radioactive substance loses 12% of its mass each year. Initially, the sample weighs 200 g.

1. Determine a model for M_n, the mass (in grams) remaining after n years.

$M_n =$ $\square$

2. Is this an example of exponential decay?
   ☐ Yes
   ☐ No

3. Calculate the mass remaining after 10 years.

$\square$ g (round to the nearest integer)