## 7.2 Exponential Functions and their Equations

Graph each function and complete the table below:

a) $f(x) = 1(2)^x$

b) $g(x) = 1(3)^x$

c) $h(x) = 4(2)^x$ → y-int.

d) $j(x) = 1\left(\dfrac{1}{2}\right)^x$

e) $k(x) = 2\left(\dfrac{1}{3}\right)^x$

| x | f(x) | g(x) | h(x) | j(x) | k(x) |
|---|------|------|------|------|------|
| -2 | $1/4$ | $1/9$ | 1 | 4 | 18 |
| -1 | $1/2$ | $1/3$ | 2 | 2 | 6 |
| 0 | 1 | 1 | 4 | 1 | 2 |
| 1 | 2 | 3 | 8 | $1/2$ | $2/3$ |
| 2 | 4 | 9 | 16 | $1/4$ | $2/9$ |
| 3 | 8 | 27 | 32 | $1/8$ | $2/27$ |
| y-int. | 1 | 1 | 4 | 1 | 2 |
| Incr./decr. | incr. | incr. | incr. | decr. | decr. |

(h(x) column: ×2; j(x) $×\frac{1}{2}$; k(x) ×3 then ×$\frac{1}{3}$)

- For *k(x)* predict the y-intercept and whether or not it is increasing

- What relationship exists between consecutive values of an exponential function? *consecutive values are multiplied by the base as x increases*

- Do the parameters affect end behaviour, domain or range?
  *nope   nope   nope*
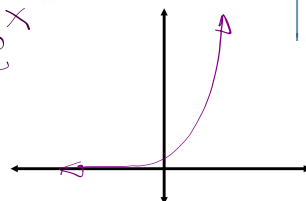  *for all : $QII \to I$   $x \in \mathbb{R}$   $\{y \in \mathbb{R} \mid y > 0\}$*

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**EXAMPLE 1** Connecting the characteristics of an increasing exponential function to its equation and graph

Predict the number of x-intercepts, the y-intercept, the end behaviour, the domain, and the range of the following function:
*none*   *y = 1*   *$QII \to QI$*

$x \in \mathbb{R}$   $\{y \in \mathbb{R} \mid y > 0\}$   $y = e^x$

Use the equation of the function to make your predictions. Verify your predictions by creating a table of values and graphing of the function.

$y = \boxed{2^{nd}}\boxed{Ln} = e^x$

EXAMPLE 2 Connecting the characteristics of a decreasing exponential function to its equation and graph

Predict the number of x-intercepts, the y-intercept, the end behaviour, the domain, the range, and whether this function is increasing or decreasing:

*(handwritten annotations: O, 9, $\pi \to \pi$, $x \in \mathbb{R}$, $y > 0$, $\frac{2}{3} < 1$)*

$$y = 9\left(\frac{2}{3}\right)^x$$

Use the equation of the function to make your predictions. Verify your predictions by creating a table of values and graphing the function.

## Your Turn

Predict the number of x-intercepts, the y-intercept, the end behaviour, the domain, the range, and whether this function is increasing or decreasing:

*(handwritten annotations: $y = 8$, Same as above, $\frac{3}{4} < 1$)*

$$f(x) = 8\left(\frac{3}{4}\right)^x$$

Use the equation of the function to make your predictions. Verify your predictions by creating a table of values and graphing the function.

EXAMPLE 3 Matching an exponential equation with its corresponding graph

Which exponential function matches each graph below? Provide your reasoning.

**i)** $y = 3(0.2)^x$    **ii)** $y = 4(3)^x$    **iii)** $y = 4(0.5)^x$    **iv)** $y = 2(4)^x$

a)

b)

c)

d)

*(handwritten: increasing, decreasing, 8)*

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