

SECT 9.1 - EXPONENTIAL FUNCTIONS

DAY 2

Opener: Which t-tables represent an exponential function?

<table border="1"> <thead> <tr> <th>x</th> <th>y</th> </tr> </thead> <tbody> <tr> <td>-2</td> <td>5</td> </tr> <tr> <td>0</td> <td>10</td> </tr> <tr> <td>2</td> <td>15</td> </tr> <tr> <td>4</td> <td>20</td> </tr> </tbody> </table> <p>Exponential? NO</p>	x	y	-2	5	0	10	2	15	4	20	<table border="1"> <thead> <tr> <th>x</th> <th>y</th> </tr> </thead> <tbody> <tr> <td>-2</td> <td>3</td> </tr> <tr> <td>0</td> <td>9</td> </tr> <tr> <td>2</td> <td>27</td> </tr> <tr> <td>4</td> <td>81</td> </tr> </tbody> </table> <p>Exponential? YES</p>	x	y	-2	3	0	9	2	27	4	81	<table border="1"> <thead> <tr> <th>x</th> <th>y</th> </tr> </thead> <tbody> <tr> <td>-2</td> <td>8/3</td> </tr> <tr> <td>0</td> <td>6</td> </tr> <tr> <td>2</td> <td>13.5</td> </tr> <tr> <td>4</td> <td>30.375</td> </tr> </tbody> </table> <p>Exponential? YES</p>	x	y	-2	8/3	0	6	2	13.5	4	30.375	<table border="1"> <thead> <tr> <th>x</th> <th>y</th> </tr> </thead> <tbody> <tr> <td>-2</td> <td>4</td> </tr> <tr> <td>0</td> <td>0</td> </tr> <tr> <td>2</td> <td>4</td> </tr> <tr> <td>4</td> <td>16</td> </tr> </tbody> </table> <p>Exponential? NO</p>	x	y	-2	4	0	0	2	4	4	16
x	y																																										
-2	5																																										
0	10																																										
2	15																																										
4	20																																										
x	y																																										
-2	3																																										
0	9																																										
2	27																																										
4	81																																										
x	y																																										
-2	8/3																																										
0	6																																										
2	13.5																																										
4	30.375																																										
x	y																																										
-2	4																																										
0	0																																										
2	4																																										
4	16																																										

Solving exponential equations

2 steps:

- 1) get the bases to be the same
- 2) set exponents equal to each other

1. $3^{4x+5} = 81$

$$3^{4x+5} = 3^4$$

$$4x+5 = 4$$

$$4x = -1$$

$$x = -\frac{1}{4}$$

2. $4^{8x-3} = \frac{1}{16}$

$$4^{8x-3} = 4^{-2}$$

$$8x-3 = -2$$

$$8x = 1$$

$$x = \frac{1}{8}$$

3. $2^{x^2} = 16$

$$2^{x^2} = 2^4$$

$$x^2 = 4$$

$$x = \pm 2$$

4. $5^{4y} = 25^y$

$$5^{4y} = 5^{2y}$$

$$4y = 2y$$

$$2y = 0$$

$$y = 0$$

5. $6^{2-3x} = 216^{x+5}$

$$6^{2-3x} = 6^{3(x+5)}$$

$$2-3x = 3x+15$$

$$-6x = 13$$

$$x = -\frac{13}{6}$$

6. $2^{x^2+15} = 4^{x^2+x}$

$$2^{x^2+15} = 2^{2(x^2+x)}$$

$$x^2+15 = 2x^2+2x$$

$$0 = x^2+2x-15$$

$$0 = (x+5)(x-3)$$

$$x = -5, 3$$

Finding an exponential function given two points

Case 1: Given the value of a (the y-intercept) and another point.

What is the exponential function if $f(0) = 3$ and $f(2) = 8$?

a) Write the general form of an exponential equation.

$$y = a \cdot b^x$$

c) Solve for b

$$\frac{8}{3} = b^2$$

$$\sqrt{\frac{8}{3}} = b$$

b) Plug in what you know:

$$8 = 3 \cdot b^2$$

d) Write the equation replacing a and b with correct values

$$y = 3 \cdot \left(\sqrt{\frac{8}{3}}\right)^x$$

Case 2: Given any 2 points from the function.

Find an exponential equation that contains the points (4, 4) and (6, 16).

$$y = a \cdot b^x \quad \left\{ \begin{array}{l} 4 = a \cdot b^4 \\ 16 = a \cdot b^6 \end{array} \right.$$

$$\frac{16 = a \cdot b^6}{4 = a \cdot b^4} \Rightarrow 4 = b^2$$

$$\boxed{b = 2}$$

* $b > 0$

$$4 = a \cdot 2^4$$

$$4 = a \cdot 16$$

$$\frac{4}{16} = a$$

$$\boxed{\frac{1}{4} = a}$$

$$y = \frac{1}{4} \cdot 2^x$$

Try some...

1) Find the exponential equation that fits the points (0, 2) and (3, 16)

$$16 = 2 \cdot b^3$$

$$8 = b^3$$

$$\boxed{2 = b}$$

$y = \text{int}(a)$

$$y = 2(2)^x$$

2) Find the exponential equation that fits the points (3, 5) and (5, 20)

$$\frac{20 = a \cdot b^5}{5 = a \cdot b^3} \Rightarrow 4 = b^2$$

$$4 = b^2$$

$$\boxed{b = 2}$$

$$5 = a \cdot 2^3$$

$$5 = a \cdot 8$$

$$\boxed{\frac{5}{8} = a}$$

$$y = \frac{5}{8}(2)^x$$

3) Find the exponential equation that fits the points (-1, 48) and (3, 3)

a) exponential equation

$$48 = a \cdot b^{-1}$$

$$\frac{48 = a \cdot b^{-1}}{3 = a \cdot b^3} \Rightarrow (16)^{-1/4} = (b^{-4})^{-1/4}$$

$$(16)^{-1/4} = (b^{-4})^{-1/4}$$

$$(2^4)^{-1/4} = b$$

$$2^{-1} = b$$

$$\boxed{\frac{1}{2} = b}$$

$$3 = a \cdot \left(\frac{1}{2}\right)^3$$

$$3 = a \cdot \left(\frac{1}{8}\right)$$

$$\boxed{24 = a}$$

b) find y when x is 6.

$$y = 24 \left(\frac{1}{2}\right)^6$$

$$y = 24 \left(\frac{1}{64}\right)$$

$$\boxed{y = \frac{3}{8}}$$