Exponential Functions

$$\frac{(a^2b^3)(a^{-5}b^2)^3}{a^{-4}b^2}$$

$$\frac{(a^2b^3)(a^{-15}b^6)}{a^{-4}b^2}$$

$$\frac{a^{-13}b^{9-2}}{a^{-4+2}}$$

$$\frac{b^7}{a^9}$$

$$\sqrt[5]{a^2} = a^{2/5}$$

$$\left(4^{-3/2} + 2^{-1}\right)^{-1}$$

$$\left(\frac{1}{\sqrt[2]{4^3}} + \frac{1}{2}\right)^{-1}$$

$$\left(\frac{1}{8} + \frac{1}{2}\right)^{-1}$$

$$\left(\frac{5}{8}\right)^{-1}$$

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

$$(x+3)^2$$

Exponential Functions – constant base, variable exponent

$y = 2^x$

$y = b^x$

$b > 0,\ b \neq 1$

Domain: $(-\infty, \infty)$

Range: $y > 0$ $(0, \infty)$

$$\left(\frac{1}{9}\right)^{3x} = \left(\sqrt[4]{27}\right)^{x+3}$$

$$\left(3^{-2}\right)^{3x} = \left(\sqrt[4]{3^3}\right)^{x+3}$$

$$3^{-6x} = \left(3^{3/4}\right)^{x+3}$$

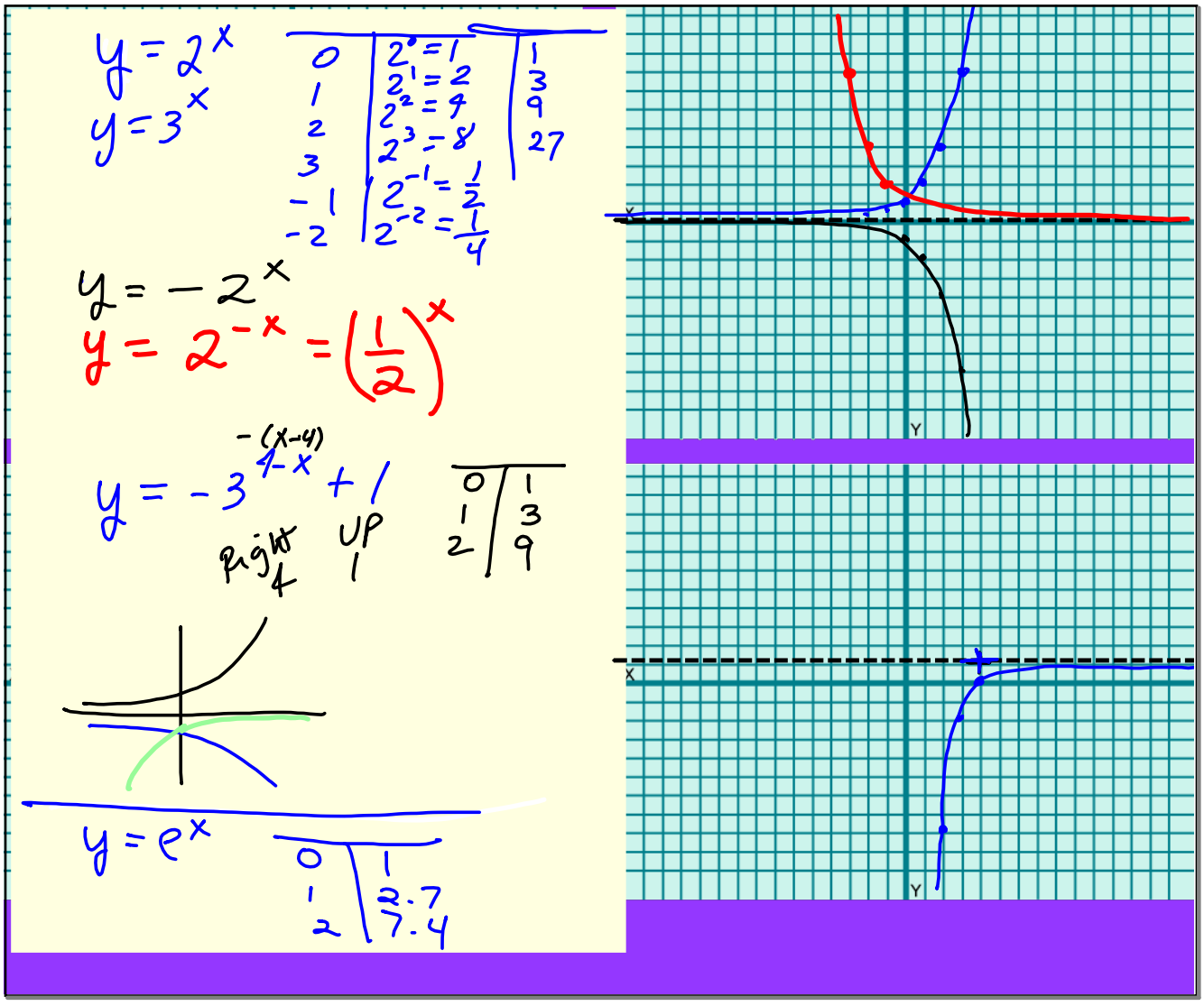
$$3^{-6x} = 3^{\frac{3}{4}x + \frac{9}{4}}$$

$$-6x = \frac{3}{4}x + \frac{9}{4}$$

$$-24x = 3x + 9$$

$$\frac{-27x}{-27} = \frac{9}{-27}$$

$$x = -\frac{1}{3}$$


$y = 2^x$
$y = 3^x$
0 | $2^0 = 1$ | 1
1 | $2^1 = 2$ | 3
2 | $2^2 = 4$ | 9
3 | $2^3 = 8$ | 27
-1 | $2^{-1} = \frac{1}{2}$
-2 | $2^{-2} = \frac{1}{4}$
$y = -2^x$
$y = 2^{-x} = \left(\frac{1}{2}\right)^x$
$y = -3^{-(x-4)} + 1$
$-x$
Right 4
UP 1
0 | 1
1 | 3
2 | 9
$y = e^x$
0 | 1
1 | 2.7
2 | 7.4
Y
X
Y

$$e = \left(1 + \frac{1}{n}\right)^n \simeq 2.718$$

Leonard Euler

Nature number

$n = 1 \quad 2$
$n = 2 \quad 2.25$
$n = 3 \quad 2.37$
$n = 4 \quad 2.4\ldots$

Exponential Growth

(Business/Human pop)

$$N = N_0 (1 \pm r)^t$$

Final, Initial Amt

Natural Growth

$$q = q_0 e^{kt}$$

Compound Interest

time

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$

interest rate

Final Amt, Principal, # of times compounded in a year

Compounded continuously

$$A = P\left(1 + \frac{r}{\infty}\right)^{\infty t}$$

$$A = Pe^{rt}$$

Culture of Bacteria

$K = 0.42$

20 bacteria now

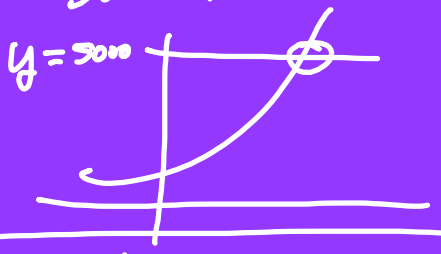
How many will there be in 12 hrs.?

$q = q_0 \cdot e^{Kt}$

$q = 20 \cdot e^{(0.42 \cdot 12)}$

≈ 3089 bacteria

When will there be 5000 bacteria?



To sub in x-coord

1) Use Table

2) eq | $x = 12$