# C12 - 7.0 - Exponential Review

$$F = \frac{P^*\left(\left(1+\frac{r}{n}\right)^{tn}-1\right)}{\frac{r}{n}}$$

## ***Interest***

**KEY**

$$F = P(1 \pm r)^t$$

$F$ : *Future Amount*
$P$ : *Present Amount*
$r$ : *Interest rate as decimal*
$t$ : *time*

;+= *Growth*
−= *Decay*

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$$F = P\left(1 \pm \frac{r}{n}\right)^{tn}$$ ; with Compounding

$n$ : *# of compounding periods per year*
$\frac{r}{n}$: *Rate per period*
$tn$: *number of periods*

$$n = \frac{1}{T}$$

*Yearly*; $n = 1$
*Monthly*; $n = 12$
*Weekly*; $n = 52$

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## ***Growth*** & ***Decay***

$$F = P(r)^{\frac{t}{T}}$$ ; Growth with "T"

$T$: *Time/Amount for Rate to* ***OCCUR***

$$F = 100(.87)^t$$

$$F = 100\left(\frac{1}{2}\right)^{\frac{t}{5}}$$

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$$F = Pe^{kt}$$ ; Continuous Growth

$e$: *constant* $\approx 2.718$
$k$: *proportional constant*

| *Growth* | 2% = .02 | 15% = .15 | 40% = .4 | 50% = .5 | 60% = .6 | 100% = 1.00 | *Double* |
|---|---|---|---|---|---|---|---|
| $(1+r)$ | $(1+.02)$ | $(1+.15)$ | $(1+.4)$ | $(1+.5)$ | $(1+.6)$ | $(1+1.00)$ | |
| (.....) | (1.02) | (1.15) | (1.4) | (1.5) | (1.6) | (2) | (2) |

| *Decay* | 10% = .1 | 15% = .15 | 40% = .4 | 50% = .5 | 60% = .6 | 95% = .95 | $Half-Life$ |
|---|---|---|---|---|---|---|---|
| $(1-r)$ | $(1-.1)$ | $(1-.15)$ | $(1-.4)$ | $(1-.5)$ | $(1-.6)$ | $(1-.95)$ | |
| (.....) | (.9) | (.85) | (.6) | (.5) | (.4) | (.05) | $(\frac{1}{2})$ |

*Method*: *Arbitrarily set* $P$ = 100% *or* 100 *or* 1

*Remember*: *The exponent is the time or the number of time periods.*

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## ***Intensity***

**KEY**

$$I = 10^{b-s}$$ ; Earthquakes, pH

$$I = 10^{\frac{b-s}{10}}$$ ; Sound

$I = \frac{I_b}{I_s}$: *Intensity*
$b$ − *Larger Richter, Debibel, pH etc*
$s$ − *Smaller Richter, Decibel, pH etc*

$pH = -\log(H^+)$
$H^+$- Concentration of Hydrogen

Change of Base

$$x^m \times x^n = x^{m+n} \quad \frac{x^m}{x^n} = x^{m-n} \quad (x^m)^n = x^{m\times n} \quad x^{-a} = \frac{1}{x^a} \quad \frac{1}{x^{-a}} = x^a \quad x^{\frac{m}{n}} = \sqrt[n]{x^m} \quad \left(\frac{x}{y}\right)^{-m} = \frac{y^m}{x^m}$$

Blank

# C12 - 7.1 - Exponent Laws Notes

Simplify

$5^2 \times 5^3 = 5^5$ Add Exponents

$\frac{3^5}{3^2} = 3^3$ Subtract Exponents

$(2^2)^3 = 2^6$ $(3 \times 4)^2 = 3^2 \times 4^2$

$(2x)^3 = 2^3x^3 = 8x^3$ $\left(\frac{3}{5}\right)^2 = \frac{3^2}{5^2}$ Multiply/Distribute Exponents

$5^{-2} = \frac{1}{5^2}$ $\frac{1}{3^{-2}} = \frac{3^2}{1}$ $3a^{-2} = \frac{3}{a^2}$ $(2x)^{-3} = \frac{1}{(2x)^3}$ Negative Exponents

$3^{-1} = \frac{1}{3}$ $\frac{1}{3^1} = 3^{-1}$ $3^{-3}a^{-2} = \frac{1}{3^3a^2}$ $\left(\frac{5}{3}\right)^{-2} = \frac{3^2}{5^2}$ $\frac{1}{25} = \frac{1}{5^2} = 5^{-2}$

$9 = 3^2$ $25 = 5^2$ $4^2 = (2^2)^2 = 2^4$ $27^4 = (3^3)^4 = 3^{12}$ Change Base

$5^{\frac{3}{4}} = \sqrt[4]{5^3}$ $8^{\frac{1}{3}} = \sqrt[3]{8}$

$8^{\frac{2}{3}} =$
$\sqrt[3]{8^2} =$
$2^2 = 4$

$\sqrt[4]{\frac{1}{16}} =$
$\frac{\sqrt[4]{1}}{\sqrt[4]{16}} = \frac{1}{2}$ Radicals

$\frac{3^4 \times 3^{-3}}{9} =$
$\frac{3^1}{3^2} =$
$3^{-1} =$
$\frac{1}{3^1} = \frac{1}{3}$

Add Exponents
Change Base
Subtract Exponents
Negative Exponents
Simplify

$\frac{4^2 \times 16^3}{128^2} =$
$\frac{((2^2)^2 \times (2^4)^3)}{(2^7)^2} =$
$\frac{2^4 \times 2^{12}}{2^{14}} =$
$\frac{2^{16}}{2^{14}} =$
$2^{(16-14)} =$
$2^2 = 4$

Change of base
Multiply Exponents
Add Exponents

Subtract Exponents
Simplify

# C12 - 7.1 - Simplifying/Separating Exponents Notes

Simplify

$3^x \times 3 =$
$3^x \times 3^1 = 3^{x+1}$

Add Exponents

$(5^2)^x = 5^{2x}$

Multiply Exponents

$\frac{6^x}{6} =$
$\frac{6^x}{6^1} = 6^{x-1}$

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

Subtract Exponents

Separate into a multiplication/division/or use brackets with the same base. $(Isolate\ \#^x)$

$6^{x+1} = 6^x(6^1) = 6(6^x)$

$5^{2x} = (5^x)^2 = (5^2)^x$

$7^{x-1} = 7^x \times 7^{-1} = \frac{7^x}{7^1}$

$4^{1-x} = 4^1(4^{-x})$
$= \frac{4}{4^x}$

$3^{2x+1} = 3^{2x}3^1$
$= (3^x)^2 3^1$
$= 3(3^x)^2$

$6^x = (2 \times 3)^x$
$= 2^x \times 3^x$

$\frac{2^{7x+5} \times 8^{x+1}}{4^{x-2}} =$
$\frac{2^{7x+5} \times (2^3)^{x+1}}{(2^2)^{x-2}} =$
$\frac{2^{7x+5} \times 2^{3x+3}}{2^{2x-4}} =$
$\frac{2^{10x+8}}{2^{2x-4}} = 2^{8x+12}$

Change Base
Multiply Exponents
Add Exponents
Subtract Exponents

Subtracting Negative Exponents!

$\frac{2^{7x+5} \times 8^{x+1}}{4^{x-2}} =$ $8^{(x+1)} =$
$(2^3)^{(x+1)} = 2^{3x+3}$

$\frac{2^{7x+5} \times 2^{3x+3}}{2^{2x-4}} =$ $4^{x-2} =$
$(2^2)^{x-2} = 2^{2x-4}$

# C12 - 7.2 - Solving Exponential Equations Notes

*Solve for x*

$2^x = 4^2$
$2^x = (2^2)^2$
$2^x = 2^4$
$x = 4$

$4 = 2^2$

Same Base: Make exponents equal to each other

Check Answer:
$2^4 = 4^2$
$16 = 16$ ✓

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$2^x 2^1 = 2^5$
$2^{x+1} = 2^5$
$x + 1 = 5$
$x = 4$

Add Exponents

$2^x 2^1 = 2^5$
$2^4 2^1 = 2^5$
$2^5 = 2^5$ ✓

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$4^{x+1} = 8^{2x-2}$
$(2^2)^{x+1} = (2^3)^{2x-2}$
$2^{2x+2} = 2^{6x-6}$
$2x + 2 = 6x - 6$
$8 = 4x$
$x = 2$

$4 = 2^2$
$8 = 2^3$

Change of Base
Multiply Exponents

Solve

$4^{x+1} = 8^{2x-2}$
$4^{2+1} = 8^{2(2)-2}$
$4^3 = 8^2$
$64 = 64$ ✓

---

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

$2^0 = 1$

Change of Base

Factor

Solve

$2^{x^2-x} = 1$
$2^{0^2-0} = 1$
$2^0 = 1$
$1 = 1$ ✓

$2^{x^2-x} = 1$
$2^{1^2-1} = 1$
$2^0 = 1$
$1 = 1$ ✓

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$2^{x^2-3x} = \frac{1}{4}$
$2^{x^2-3x} = 2^{-2}$
$x^2 - 3x = -2$
$x^2 - 3x + 2 = 0$
$(x-2)(x-1) = 0$
$x = 2$ $x = 1$

$2^{-2} = \frac{1}{2^2} = \frac{1}{4}$

Change of Base

Factor

Solve

$2^{x^2-3x} = \frac{1}{4}$
$2^{2^2-3(2)} = \frac{1}{4}$
$2^{-2} = \frac{1}{4}$
$\frac{1}{4} = \frac{1}{4}$ ✓

$2^{x^2-3x} = \frac{1}{4}$
$2^{1^2-3(1)} = \frac{1}{4}$
$2^{-2} = \frac{1}{4}$
$\frac{1}{4} = \frac{1}{4}$ ✓

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$x^{\frac{2}{5}} = 3$
$\left(x^{\frac{2}{5}}\right)^{\frac{5}{2}} = (3)^{\frac{5}{2}}$
$x = 3^{\frac{5}{2}}$

$\frac{2}{5} \times \frac{5}{2} = 1$

$x = 15.5885$

Take both/sides to reciprocal exponent of variable

Brackets around the left side
Brackets around the right side

$x^{\frac{2}{5}} = 3$
$\left(3^{\frac{5}{2}}\right)^{\left(\frac{2}{5}\right)} = 3$
$3 = 3$ ✓

$x^2 = 9$ Square root both sides
$(x^2)^{\frac{1}{2}} = 9^{\frac{1}{2}}$
$x = \pm 3$
$\sqrt{x} = x^{\frac{1}{2}}$

$x^{\frac{m}{n}} = \sqrt[x]{x^m}$

$(x+1)^{\frac{2}{3}} = 16$
$\left((x+1)^{\frac{2}{3}}\right)^{\left(\frac{3}{2}\right)} = (16)^{\frac{3}{2}}$
$x + 1 = \sqrt[2]{16^3}$
$x + 1 = 4^3$
$x + 1 = 64$
$x = 63$

$(x+1)^{\frac{2}{3}} = 16$
$(63+1)^{\frac{2}{3}} = 16$
$64^{\frac{2}{3}} = 16$
$\sqrt[3]{64^2} = 16$
$4^2 = 16$
$16 = 16$ ✓

# C12 - 7.2 - Separate/Factoring/Solving Exponents Notes

*Solve for x*

$2(3^x) + 3^x = 243$ $\quad let\ m = 3^x$

$2m + m = 243$

$3m = 243$

$m = 81$

$3^x = 81$

$3^x = 3^4$

$\boxed{x = 4}$

Check Answer:

$2(3^x) + 3^x = 243$

$2(3^4) + 3^4 = 243$

$2(81) + 81 = 243$

$243 = 243$ ✓

$7^x + 7^{x+1} = 392$ $\quad Let\ m = 7^x$

$7^x + 7^x 7^1 = 392$

$m + 7m = 392$

$8m = 392$

$m = 49$

$7^x = 49$

$7^x = 7^2$

$\boxed{x = 2}$

$7^x + 7^{x+1} = 392$

$7^2 + 7^{2+1} = 392$

$49 + 343 = 392$

$392 = 392$ ✓

$(2^x)^2 - 12(2^x) + 32 = 0$ $\quad let\ m = 2^x$

$m^2 - 12m + 32 = 0$

$(m-4)(m-8) = 0$

$m - 4 = 0$ $\quad m - 8 = 0$

$m = 4$ $\quad m = 8$

$2^x = 4$ $\quad 2^x = 8$

$2^x = 2^2$ $\quad 2^x = 2^3$

$\boxed{x = 2}$ $\quad \boxed{x = 3}$

$(2^x)^2 - 12(2^x) + 32 = 0$

$(2^2)^2 - 12(2^2) + 32 = 0$

$16 - 48 + 32 = 0$ ✓

$(2^x)^2 - 12(2^x) + 32 = 0$

$(2^3)^2 - 12(2^3) + 32 = 0$

$64 - 96 + 32 = 0$ ✓

$9^{2x} - 2(9^x) - 3 = 0$

$(9^x)^2 - 2(9^x) - 3 = 0$ $\quad let\ m = 9^x$

$m^2 - 2m - 3 = 0$

$(m-3)(m+1) = 0$

$m - 3 = 0$ $\quad m + 1 = 0$

$m = 3$ $\quad m = -1$

$9^x = 3$ $\quad 9^x = -1$

$(3^2)^x = 3^1$ $\quad$ *No Solution*

$3^{2x} = 3^1$

$2x = 1$

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

$9^{2x} - 2(9^x) - 3 = 0$

$9^{2\left(\frac{1}{2}\right)} - 2\left(9^{\left(\frac{1}{2}\right)}\right) - 3 = 0$ $\quad 9^{\frac{1}{2}} = \sqrt[2]{9^1} = 3$

$9^1 - 2(3) - 3 = 0$

$9 - 6 - 3 = 0$

$0 = 0$ ✓

# C12 - 7.2 - Separate/Factoring/Solving Exponents Notes

*Solve for x*

$$4^x - 4^{x-1} - 24 = 0$$
$$4^x - \frac{4^x}{4^1} - 24 = 0$$
$$\left(4^x - \frac{4^x}{4^1} - 24 = 0\right) \times 4$$
$$4(4^x) - 4^x - 96 = 0 \qquad let\ m = 4^x$$
$$4m - m - 96 = 0$$
$$3m = 96$$
$$m = 32$$

$$4^x = 32$$
$$(2^2)^x = 2^5$$
$$2^{2x} = 2^5$$
$$2x = 5$$
$$\boxed{x = \frac{5}{2}}$$

$$4^x - 4^{x-1} - 24 = 0$$
$$4^{\left(\frac{5}{2}\right)} - 4^{\left(\frac{5}{2}\right)-1} - 24 = 0$$
$$32 - 8 - 24 = 0 \quad \checkmark$$

$$4^x + 4^{1-x} = 5$$
$$4^x + 4(4^{-x}) = 5$$
$$4^x + \frac{4}{4^x} = 5$$
$$Let\ m = 4^x \qquad m + \frac{4}{m} = 5$$
$$\left(m + \frac{4}{m} = 5\right) \times m$$
$$m^2 + 4 = 5m$$
$$m^2 + 4 = 5m$$
$$m^2 - 5m + 4 = 0$$
$$(m-1)(m-4) = 0$$

$$m - 1 = 0 \qquad m - 4 = 0$$
$$m = 1 \qquad m = 4$$

$$4^x = 1 \qquad 4^x = 4$$
$$4^x = 4^0 \qquad 4^x = 4^1$$
$$\boxed{x = 0} \qquad \boxed{x = 1}$$

$$4^x + 4^{1-x} = 5 \qquad 4^x + 4^{1-x} = 5$$
$$4^0 + 4^{1-0} = 5 \qquad 4^1 + 4^{1-1} = 5$$
$$1 + 4 = 5 \quad \checkmark \qquad 4 + 1 = 5 \quad \checkmark$$
$$5 = 5 \qquad 5 = 5$$

$$3^x - 3 = 4(3^{-x}) \qquad 3^{-x} = \frac{1}{3^x}$$
$$3^x - 3 = \frac{4}{3^x}$$
$$m - 3 = \frac{4}{m} \qquad let\ m = 3^x$$
$$\left(m - 3 = \frac{4}{m}\right) \times m$$
$$m^2 - 3m = 4$$
$$m^2 - 3m - 4 = 0$$
$$(m-4)(m+1) = 0$$

$$m - 4 = 0 \qquad m + 1 = 0$$
$$m = 4 \qquad m = -1$$

$$3^x = 4 \qquad 3^x = -1$$
$$\boxed{x = 1.2619} \qquad No\ Solution$$

$$Calc\ y_1 = y_2$$

$$3^x - 3 = \frac{4}{3^x}$$
$$3^{1.2619} - 3 = \frac{4}{3^{1.2619}}$$
$$4 - 3 = \frac{4}{4} \quad \checkmark$$
$$1 = 1$$

$$2(2^x)^2 - 3(2^x) + 1 = 0$$
$$2m^2 - 3m + 1 = 0 \qquad let\ m = 2^x$$
$$(2m-1)(m-1) = 0$$

$$2m - 1 = 0 \qquad m - 1 = 0$$
$$m = \frac{1}{2} \qquad m = 1$$

$$2^x = \frac{1}{2} \qquad 2^x = 1$$
$$2^x = 2^{-1} \qquad 2^x = 2^0$$
$$\boxed{x = -1} \qquad \boxed{x = 0}$$

$$2(2^x)^2 - 3(2^x) + 1 = 0 \qquad 2(2^x)^2 - 3(2^x) + 1 = 0$$
$$2(2^{-1})^2 - 3(2^{-1}) + 1 = 0 \qquad 2(2^0)^2 - 3(2^0) + 1 = 0$$
$$2\left(\frac{1}{2}\right)^2 - 3\left(\frac{1}{2}\right) + 1 = 0 \qquad 2(1)^2 - 3(1) + 1 = 0$$
$$2\left(\frac{1}{4}\right) - \frac{3}{2} + 1 = 0 \qquad 2 - 3 + 1 = 0$$
$$0 = 0 \quad \checkmark \qquad 0 = 0 \quad \checkmark$$

# C12 - 7.2 - Separate/Factoring/Solving Exponents Notes

*Solve for $x$*

$3^{2x+1} - 4(3^{x+1}) + 9 = 0$
$3^{2x}3^1 - 4(3^x 3) + 9 = 0$
$(3^x)^2 3 - 4(3^x)3 + 9 = 0$
$3(3^x)^2 - 12(3^x) + 9 = 0$
$3m^2 - 12m + 9 = 0$
$m^2 - 4m + 3 = 0$
$(m-1)(m-3) = 0$

Divide both sides by 3!

*let* $m = 3^x$

$3^{2x+1} - 4(3^{x+1}) + 9 = 0$
$3(3^x)^2 - 12(3^x) + 9 = 0$
$3m^2 - 12m + 9 = 0$

$3^{2x+1} = 3^{2x}3^1$
$= (3^x)^2 3^1$
$= 3(3^x)^2$

$4(3^{x+1}) = 4(3^x 3^1)$
$= 12(3^x)$

$m - 1 = 0$ | $m - 3 = 0$
$m = 1$ | $m = 3$

$3^x = 1$ | $3^x = 3$
$3^x = 3^0$ | $3^x = 3^1$

$x = 0$ | $x = 1$

$3^{2x+1} - 4(3^{x+1}) + 9 = 0$
$3^{2(0)+1} - 4(3^{(0)+1}) + 9 = 0$
$3^1 - 4(3) + 9 = 0$
$3 - 12 + 9 = 0$
$0 = 0$ ✓

$3^{2x+1} - 4(3^{x+1}) + 9 = 0$
$3^{2(1)+1} - 4(3^{(1)+1}) + 9 = 0$
$3^3 - 4(3^2) + 9 = 0$
$27 - 36 + 9 = 0$
$0 = 0$ ✓

$10^x - 4(5^x) - 5(2^x) + 20 = 0$
$2^x \times 5^x - 4(5^x) - 5(2^x) + 20 = 0$
$mn - 4n - 5m + 20 = 0$
$(mn - 4n)(-5m + 20) = 0$
$n(m-4) - 5(m-4) = 0$
$(n-5)(m-4) = 0$

*let* $m = 2^x$

*let* $n = 5^x$

$10^x = (2 \times 5)^x$
$= 2^x \times 5^x$

$n - 5 = 0$ | $m - 4 = 0$
$n = 5$ | $m = 4$

$5^x = 5$ | $2^x = 4$
$5^x = 5^1$ | $2^x = 2^2$

$x = 1$ | $x = 2$

*Group*

$10^x - 4(5^x) - 5(2^x) + 20 = 0$
$10^1 - 4(5^1) - 5(2^1) + 20 = 0$
$10 - 20 - 10 + 20 = 0$
$0 = 0$ ✓

$10^x - 4(5^x) - 5(2^x) + 20 = 0$
$10^2 - 4(5^2) - 5(2^2) + 20 = 0$
$100 - 100 - 20 + 20 = 0$
$0 = 0$ ✓

# C12 - 7.3 - Half Life (HL) Theory

Bananas have a half life of 4 days.

Half Life: Time to decay to half of the remaining mass.

| | | | | | |
|---|---|---|---|---|---|
| *Fraction Remaining* | 1 | $\frac{1}{2}$ | $\frac{1}{4}$ | $\frac{1}{8}$ | $\frac{1}{16}$ |
| *Mass (grams)* | 100 *g* | 50 *g* | 25 *g* | 12.5 *g* | 6.25 *g* |
| *Time (days)* | 0 | 4 | 8 | 12 | 16 |
| *# Half Lives* | 0 | 1 | 2 | 3 | 4 |

How long till 3.125 g?

How much after 28 days?

How long till $\frac{1}{256}th\ of\ original$?

| | | | | |
|---|---|---|---|---|
| $\frac{1}{16}$ | $\frac{1}{32}$ | $\frac{1}{64}$ | $\frac{1}{128}$ | $\frac{1}{256}$ |
| 6.25 *g* | 3.125 *g* | 1.5625 *g* | 0.78125 *g* | 0.390625 |
| 16 | 20 | 24 | 28 | 32 |

$$F = P(r)^{\frac{t}{T}}$$

$$3.125 = 100\left(\frac{1}{2}\right)^{\frac{t}{4}}$$

$$t = 20\ d$$

$$F = P(r)^{\frac{t}{T}}$$

$$F = 100\left(\frac{1}{2}\right)^{\frac{28}{4}}$$

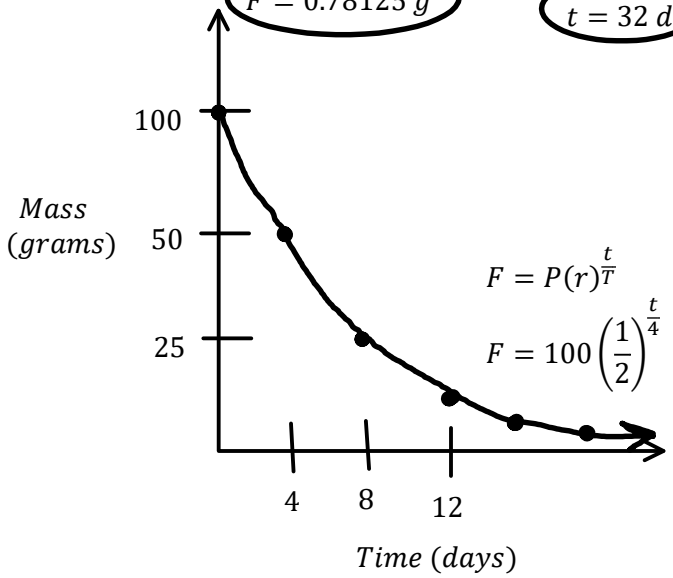
$$F = 0.78125\ g$$

$$F = P(r)^{\frac{t}{T}}$$

$$\frac{1}{256} = 1\left(\frac{1}{2}\right)^{\frac{t}{4}}$$

$$t = 32\ d$$

| *t* | *g* |
|---|---|
| *0* | *100* |
| *4* | *50* |
| *8* | *25* |
| *12* | *12.5* |
| *16* | *6.25* |
| *20* | *3.125* |
| *24* | *1.5625* |
| *28* | *0.78125* |
| *32* | *0.390625* |




$$F = P(r)^{\frac{t}{T}}$$

$$F = 100\left(\frac{1}{2}\right)^{\frac{t}{4}}$$

# C12 - 7.3 - Word Problems Notes

If you deposit $2000 in the bank at 12% interest how much will you have after 8 years?

$$F = P(1 \pm r)^t$$
$$F = 2000(1 + 0.12)^8$$
$$F = 4951.93$$

If you deposit $5000 in the bank at 8% interest, compounded quarterly, how much will you have after 6 years?

$$F = P\left(1 \pm \frac{r}{n}\right)^{tn}$$
$$F = 5000\left(1 + \frac{0.08}{4}\right)^{6\times4}$$
$$F = 8042.19$$

Find the rate to triple your money in 10 years.

$$F = P(1 + r)^t$$
$$3 = 1(1 + r)^{10}$$
$$(3)^{\frac{1}{10}} = \left((1 + r)^{10}\right)^{\frac{1}{10}}$$
$$1.116 = 1 + r$$
$$r = 0.1116 = 11.6\%$$

If a population starts at 1000 and triples every 4 hours, how large will the population grow in 25 hours?

$$F = P(r)^{\frac{t}{T}}$$
$$F = 1000(3)^{\frac{25}{4}}$$
$$F = 959417\ pop$$

If the population starts at 300 and grows continuously at a rate of 0.06, how large will it grow after 20 days?

$$F = Pe^{kt}$$
$$F = 300e^{0.06\times20}$$
$$F = 996.03\ pop$$

How many times as intense is an earthquake of 6.0 than 3.0?

$$I = 10^{b-s}$$
$$I = 10^{6-3}$$
$$I = 10^3$$
$$I = 1000\ times$$

Find the present value of deposit worth $2000 in the bank at 10% interest how much will you have after 4 years?

$$F = P(1 \pm r)^t$$
$$2000 = P(1 + 0.1)^4$$
$$2000 = P(1.4641)$$
$$P = \frac{2000}{1.1641}$$
$$P = \$1366.03$$

Find the rate of a $1000 deposit worth $1100 after 2 years.

$$F = P(1 \pm r)^t$$
$$1100 = 1000(1 + r)^2$$
$$\frac{1100}{1000} = (1 + r)^2$$
$$1.1 = (1 + r)^2$$
$$(1.1)^{\frac{1}{2}} = \left((1 + r)^2\right)^{\frac{1}{2}}$$
$$1.0488 = 1 + r$$
$$r = 0.0488$$
$$r = 4.9\%$$

How long to quadruple your money at 8%

$$F = P(1 \pm r)^t$$
$$400 = 100(1 + 0.08)^t$$
$$\frac{400}{100} = 1.08^t$$
$$4 = 1.08^t$$

$y_1 = y_2$

$Calc\ Intersection\ or\ "logs"$

$$t = 18.01\ yrs$$

If you deposit $100 in the bank, how long will it take to grow to $6400 if it doubles each year?

$$F = P(r)^{\frac{t}{T}}$$
$$6400 = 100(2)^{\frac{t}{1}}$$
$$\frac{6400}{100} = 2^t$$
$$64 = 2^t$$
$$2^6 = 2^t$$
$$t = 6s$$

An earth quake in California of Richter 8.5 Magnitude was 100 times as strong as an earth quake in Vancouver of what Richter Magnitude.

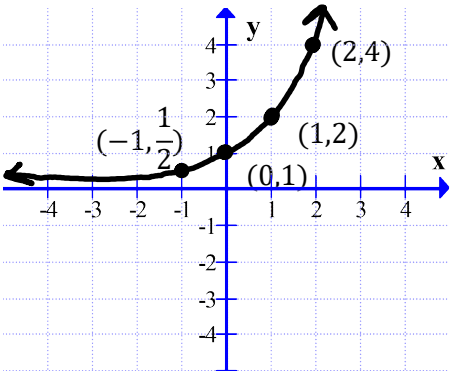
$$I = 10^{b-s}$$
$$100 = 10^{8.5-s}$$
$$10^2 = 10^{8.5-s}$$
$$2 = 8.5 - s$$
$$s = 6.5\ R$$

Light diminishes by 10% every 5 meters. Find the depth of 1% light.

$$F = P(1 \pm r)^{\frac{t}{T}}$$
$$1 = 100(1 - 0.1)^{\frac{d}{5}}$$
$$0.01 = 0.9^{\frac{d}{5}}$$
$$d = 218.5\ m$$

# C12 - 7.4 - Exponent Reflections Graphs Notes

$y = 2^x$




| $x$ | $y$ |
|---|---|
| $-1$ | $\frac{1}{2}$ |
| 0 | 1 |
| 1 | 2 |
| 2 | 4 |

$2^{-1} = \frac{1}{2}$ $\quad (-1,\frac{1}{2})$

$2^0 = 1$ $\quad (0,1)$

$2^1 = 2$ $\quad (1,2)$

$2^2 = 4$ $\quad (2,4)$

End Behavior

$x \to +\infty$
$y \to +\infty$

$x \to -\infty$
$y \to 0$

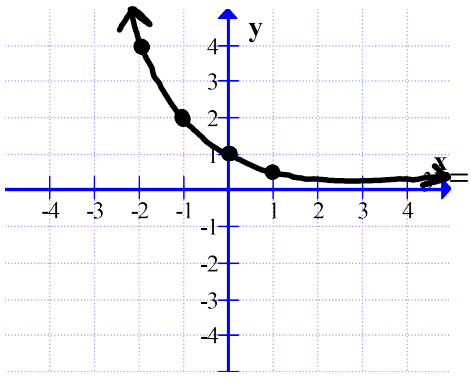
$HA$:

$y = 0$

*Domain*: $xER$

Eg. Time* $t \geq 0$

$y = 2^{-x}$ Horizontal Reflection



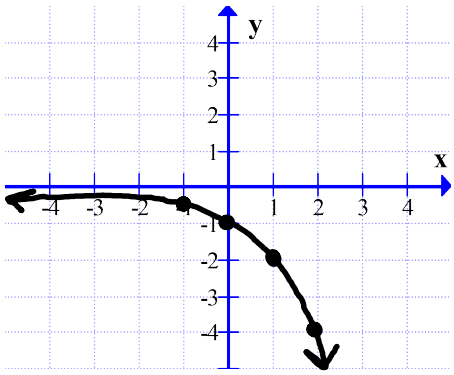

$= \left(\frac{1}{2}\right)^x$

$\left(\frac{1}{2}\right)^x = (2^{-1})^x = 2^{-x}$

$x \to +\infty$
$y \to 0$

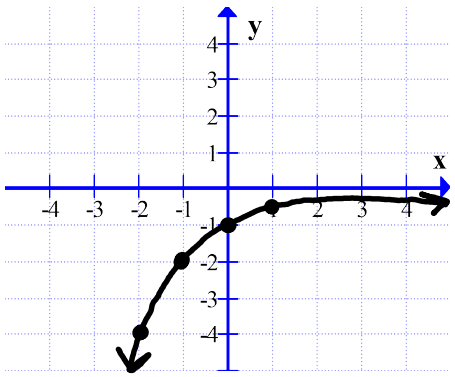
$x \to -\infty$
$y \to +\infty$

Remember: Positive Open up to the Right
Remember: Negative exponents and fractions with positive exponents Down to the Right




Vertical Reflection

$y = -2^x$

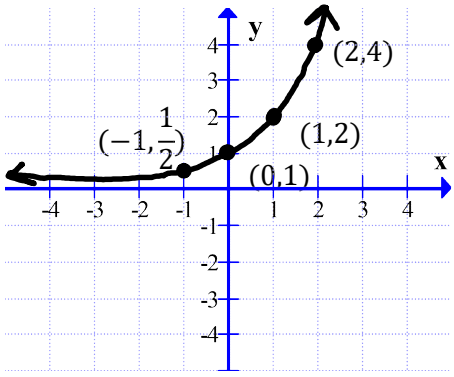



Vertical Reflection and
Horizontal Reflection

$y = -2^{-x}$

# C12 - 7.4 - Exponent Transformations Graphs Notes

$y = 2^x$



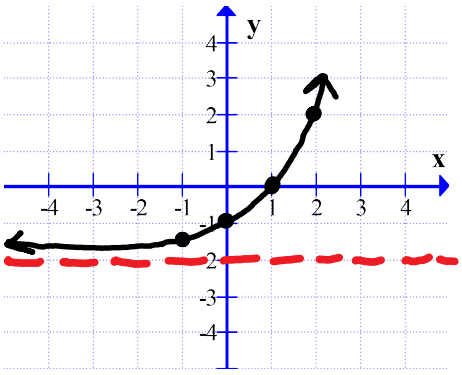

| $x$ | $y$ |
|---|---|
| $-1$ | $\frac{1}{2}$ |
| 0 | 1 |
| 1 | 2 |
| 2 | 4 |

$2^{-1} = \frac{1}{2}$ $\quad (-1,\frac{1}{2})$

$2^0 = 1$ $\quad (0,1)$

$2^1 = 2$ $\quad (1,2)$

$2^2 = 4$ $\quad (2,4)$




$y = 2^x - 2$

Down 2

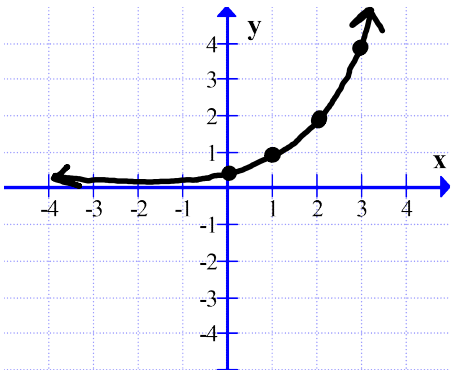
$y - 2$

$y = C^x \pm HA$

$HA$:

$y = -2$

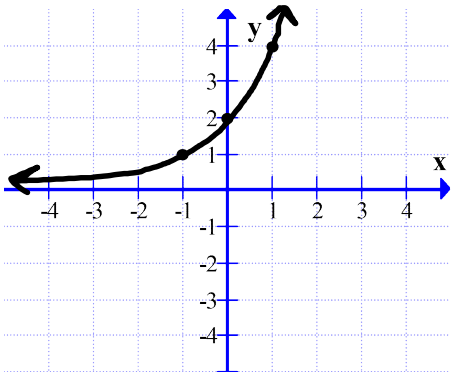
$$y = a(C)^{b(x-h)} + k$$




$y = 2^{x-1}$

Right One

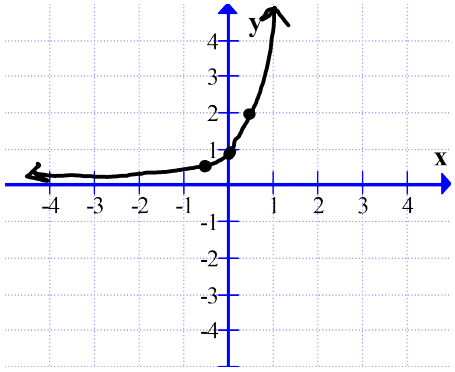
$x + 1$




$y = 2(2^x)$

Vertical Expansion = 2

$y \times 2$




$y = 2^{2x}$

Horizontal Compression = 1/2

$x \div 2$