Warm-Up

Factor each completely.

1) $25m^2 + 10m - 35$

Simplify each expression.

2) $\dfrac{x - 9}{x^2 - 12x + 27}$

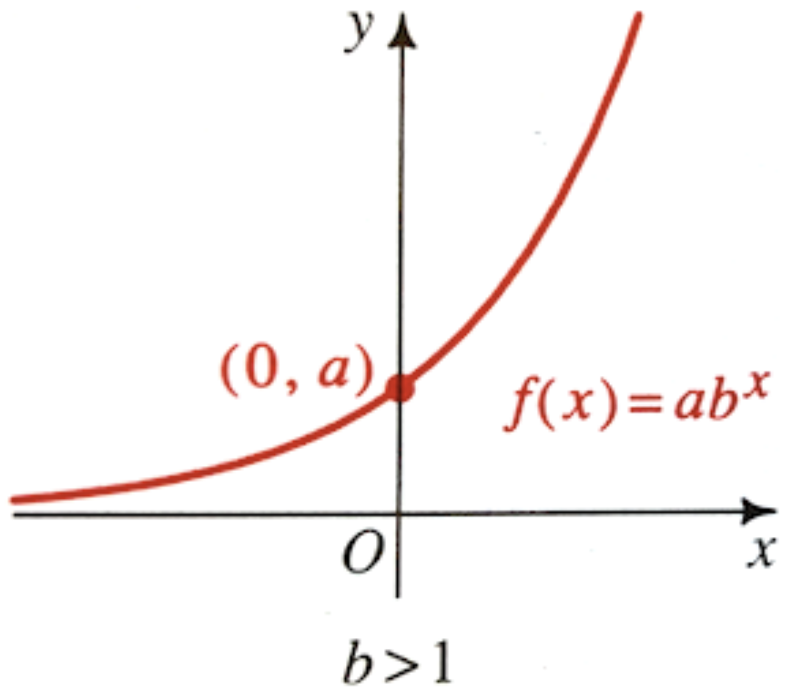
3) $\dfrac{n^2 + 2n - 63}{n^2 - 2n - 35}$

5-3
Exponential Functions

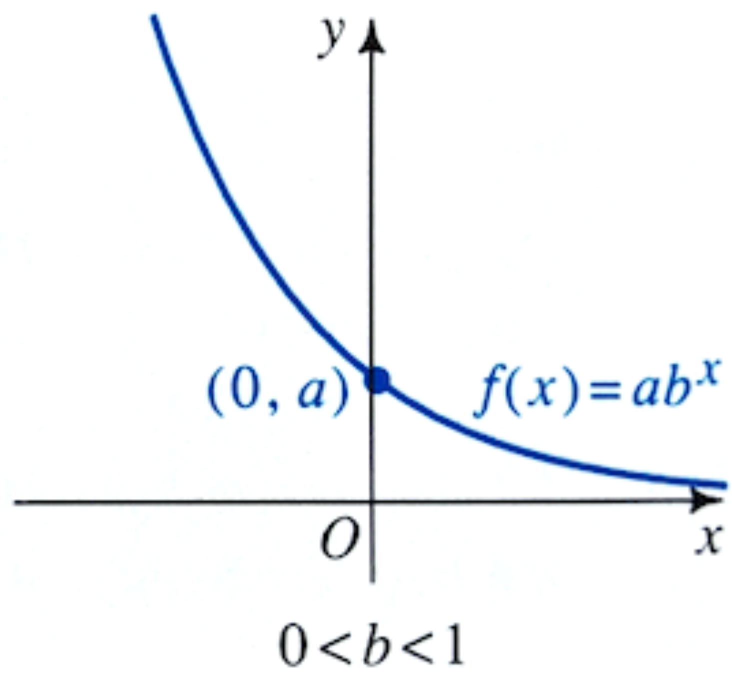
Learning Targets:

- I can define and use exponential functions.

Remember:



Exponential growth



Exponential decay

Example 1:

If f is an exponential function, $f(0) = 3$, and $f(2) = 12$, find $f(-2)$.

Since f is an exponential function, then $f(x) = ab^x$.

Since $f(0) = 3$, then $3 = ab^0$

$$3 = a$$

Now, since $f(2) = 12$, then $12 = 3 * b^2$

$$4 = b^2$$

$$2 = b$$

So, $\boldsymbol{f(x) = 3 * 2^x}$

$$f(-2) = 3 * 2^{-2}$$

$$= 3 * .25$$

$$= .75$$

Example 2:

A bank advertises that if you open a savings account, you can double your money in 12 years. What is the bank's rate?

$$A(t) = A_0(1+r)^t$$

A_0: amount at time $t = 0$

r: growth rate

$$2A_0 = A_0(1+r)^{12}$$

$$2 = (1+r)^{12}$$

$$\sqrt[12]{2} = 1+r$$

$$2^{\frac{1}{12}} = 1+r$$

$$1.059 = 1+r$$

$$.059 = r$$

$$5.9\% = r$$

Let’s get real though…

Actual interest rates for *savings* accounts

Bank Account	Minimum Balance for Rate	APY
Wells Fargo Platinum Savings	$100,000	0.05%
HSBC Advance Savings	$15,000	0.05%
Citizens Access Online Savings Account	$5,000	2.35%
Ally Bank Online Savings	$0	2.20%
Marcus by Goldman Sachs High-Yield Savings	$0	2.25%
Synchrony High-Yield Savings	$0	2.25%

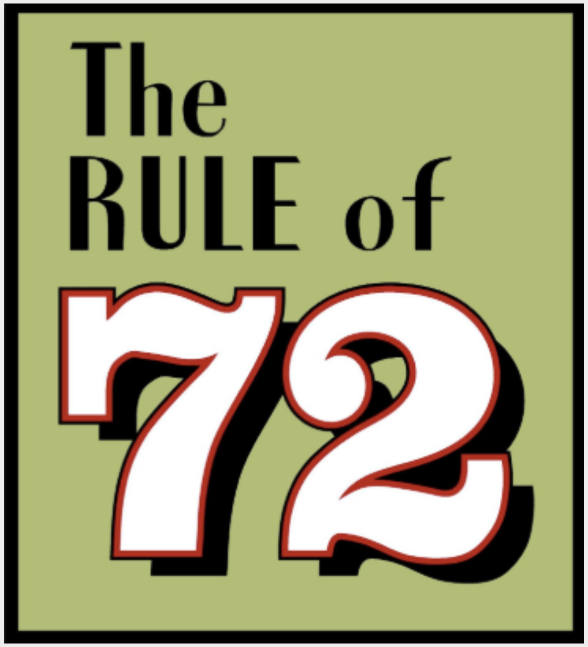
Let’s get real though…

Actual interest rates for *linked checking savings* accounts

Bank Account	Standard APY	Minimum Balance for Relationship Rate	APY
Chase Premier Savings	0.01%	$0 $50,000 $100,000 $250,000	0.04% 0.07% 0.08% 0.11%
Fifth Third Relationship Savings	0.01% – 0.05%	$0.01 $25,000	0.02% 0.10%
PNC Standard Savings	0.01%	$1 $2,500	0.05% 0.10%
TD Bank Preferred Savings	0.05% – 0.35%	$0.01 $20,000 $50,000 $100,000 $250,000 $10,000,000	0.05% 0.20% 0.35% 0.35% 0.35% 0.35%

The Rule of 72

If a quantity is growing at a rate of $r\%$ per year (or month), then the doubling time is approximately $(72 \div r)$ years (or months).



For example, if a quantity grows at 8% per month, then its doubling time will be about $72 \div 8 = 9$ months.

If a quantity grows at 2% per year, then its doubling time will be about $72 \div 2 = 36$ years.

Half-Life

The *half-life* of something is the amount of time it takes a given quantity to decrease to half of its initial value.

$$A(t) = A_0 \left(\frac{1}{2}\right)^{\frac{t}{k}}$$

$A(t)$: Final amount after a given time

A_0: Initial amount

t: time passed

k: half-life

Example 3:

A radioactive isotope has a half-life of 5 days. If 6.41 grams are present initially, how much will be present after 2 weeks?

$$A(t) = A_0 \left(\frac{1}{2}\right)^{\frac{t}{k}}$$

$$A(14) = 6.41 \left(\frac{1}{2}\right)^{\frac{14}{5}}$$

$$\approx 0.9204 \text{ grams}$$

Practice Problems:

5-3:

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