

SEC 3.4 - GROWTH + DECAY

REVIEW:

- ① THE TABLE SHOWS THE RELATIONSHIP BETWEEN CALORIES + GRAMS OF FAT IN AN ORDER OF FRIED CHICKEN FROM VARIOUS RESTAURANTS.

| | | | | | | |
|----------|-----|-----|-----|-----|-----|-----|
| CALORIES | 305 | 410 | 320 | 500 | 510 | 440 |
| FAT (g) | 28 | 34 | 28 | 41 | 42 | 38 |

ASSUMING A LINEAR MODEL, HOW MANY GRAMS OF FAT WOULD YOU EXPECT TO BE IN AN ORDER WITH 275 CALORIES?

- (A) 22 (B) 25 (C) 28 (D) 30

- ② SIMPLIFY:

(A) $\sqrt{48}$

(B) $\frac{r^8 + 12}{r^2 + 7}$

(C) $\left(\frac{4n^2p^4}{8p^3}\right)^3$

* EQUATION FOR EXPONENTIAL GROWTH *

$$y = a(1+r)^t$$

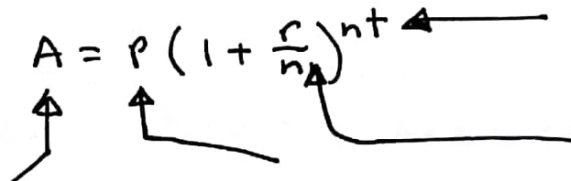
EXAMPLE 1. THE PRIZE FOR A RADIO CONTEST BEGINS WITH \$100. ONCE A DAY, A NAME IS CHOSEN. THE PERSON HAS 15 MINUTES TO CALL OR THE PRIZE INCREASES 2.5%.

- (A) WRITE AN EQUATION TO REPRESENT THE AMOUNT AFTER t DAYS.

(B) HOW MUCH WILL THE PRIZE BE WORTH AFTER 10 DAYS?

APPLICATION 1. A COLLEGE'S TUITION HAS RISEN 5% EACH YEAR SINCE 2000. IF THE TUITION IN 2000 WAS \$10,850, WRITE AN EQUATION FOR THE AMOUNT OF TUITION t YEARS AFTER 2000. PREDICT THE COST FOR 2015. SHOW WORK.

* EQUATION FOR COMPOUND INTEREST *

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


EXAMPLE 2. MARIA'S PARENTS INVESTED \$14,000 AT 6% COMPOUNDED MONTHLY. HOW MUCH MONEY WILL THEY HAVE AFTER 10 YEARS?

APPLICATION 2. DETERMINE THE AMOUNT OF AN INVESTMENT IF \$300 IS INVESTED AT AN INTEREST RATE OF 3.5% COMPOUNDED MONTHLY FOR 22 YRS. SHOW SET-UP.

* EQUATION FOR EXPONENTIAL DECAY *

$$y = a(1-r)^t$$

↑ ↑ ↑ ←

EXAMPLE 3.

A FULLY INFLATED CHILD'S RAFT FOR A POOL IS LOSING 6.6% OF ITS AIR EVERY DAY. THE RAFT ORIGINALLY CONTAINS 4500 IN³ OF AIR.

- (A) WRITE AN EQUATION TO REPRESENT THE LOSS OF AIR.
- (B) ESTIMATE THE AMOUNT OF AIR LEFT AFTER 7 DAYS. SHOW SET-UP.
- (C) ESTIMATE HOW MANY DAYS UNTIL THE RAFT CONTAINS 2500 IN³ OF AIR. SHOW SET-UP.

APPLICATION 3. THE POPULATION OF CAMPBELL COUNTY, KY HAS BEEN DECREASING AT AN AVERAGE RATE OF 0.3% PER YEAR. IN 2000, ITS POPULATION WAS 88,647.

- (A) WRITE AN EQUATION FOR THIS SITUATION.
- (B) PREDICT THE POPULATION IN 2010. SHOW SET-UP.
- (C) PREDICT WHAT YEAR THE POPULATION WILL BE AT 80,000. SHOW SET-UP.

PRACTICE.

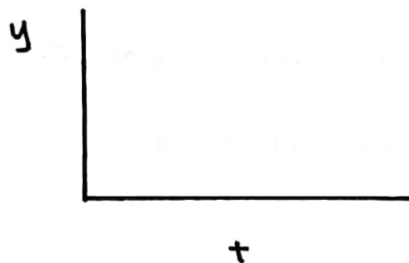
- ① MS. ACOSTA RECEIVED A JOB AS A TEACHER WITH A STARTING SALARY OF \$34,000. ACCORDING TO HER CONTRACT, SHE WILL RECEIVE A 1.5% INCREASE IN HER SALARY EVERY YEAR. HOW MUCH WILL MS. ACOSTA EARN IN 7 YEARS? SHOW SET-UP.
- ② PAUL INVESTED \$400 IN AN ACCOUNT WITH 5.5% INTEREST COMPOUNDED MONTHLY. HOW MUCH WILL HIS INVESTMENT BE WORTH IN 8 YEARS? SHOW SET-UP.
- ③ IN 2000, 2200 STUDENTS ATTENDED POLARIS H.S. THE ENROLLMENT HAS BEEN DECLINING 2% ANNUALLY.
- Ⓐ WRITE AN EQUATION FOR THE ENROLLMENT t YEARS AFTER 2000.
- Ⓑ HOW MANY STUDENTS WILL BE ENROLLED IN 2015? SHOW SET-UP.
- Ⓒ WHAT YEAR WILL THE ENROLLMENT BE 2100 STUDENTS? SHOW SET UP.
- ④ THE NUMBER OF PEOPLE WHO OWN COMPUTERS HAS INCREASED 23.2% ANNUALLY SINCE 1990. IF HALF A MILLION PEOPLE OWNED A COMPUTER IN 1990, PREDICT HOW MANY PEOPLE WILL OWN A COMPUTER IN 2018. SHOW SET-UP.

⑤ GIVEN THE EQUATION $A = 200(1 + 0.05)^t$, WHAT DOES:

- Ⓐ 200 REPRESENT?
- Ⓑ 0.05 REPRESENT?
- Ⓒ t REPRESENT?
- Ⓓ A REPRESENT?

⑥ GIVEN THE EQUATION $y = 300(0.88)^t$,

- Ⓐ IS THIS GROWTH OR DECAY?
- Ⓑ HOW MUCH (%) IS BEING LOST OR GAINED FOR EACH TIME PERIOD?
- Ⓒ WHAT DOES 300 REPRESENT?
- Ⓓ SKETCH A POSSIBLE GRAPH FOR THIS FUNCTION. LABEL APPROPRIATE POINTS AND THE HORIZONTAL ASYMPTOTE.



Ⓔ WHAT ARE THE DOMAIN AND RANGE FOR THIS FUNCTION (ASSUMING TIME ≥ 0)?

⑦ GIVEN THE EQUATION $A = 3000\left(1 + \frac{0.05}{4}\right)^{4t}$,

- Ⓐ WHAT IS THE INITIAL AMOUNT?
- Ⓑ HOW OFTEN WILL THE INVESTMENT BE COMPOUNDED?

7-6 Skills Practice**Growth and Decay**

- 1. POPULATION** The population of New York City increased from 8,008,278 in 2000 to 8,168,388 in 2005. The annual rate of population increase for the period was about 0.4%.

 - a. Write an equation for the population t years after 2000.
 - b. Use the equation to predict the population of New York City in 2015.

- 2. SAVINGS** The Fresh and Green Company has a savings plan for its employees. If an employee makes an initial contribution of \$1000, the company pays 8% interest compounded quarterly.

 - a. If an employee participating in the plan withdraws the balance of the account after 5 years, how much will be in the account?
 - b. If an employee participating in the plan withdraws the balance of the account after 35 years, how much will be in the account?

- 3. HOUSING** Mr. and Mrs. Boyce bought a house for \$96,000 in 1995. The real estate broker indicated that houses in their area were appreciating at an average annual rate of 7%. If the appreciation remained steady at this rate, what was the value of the Boyce's home in 2009?

- 4. MANUFACTURING** Zeller Industries bought a piece of weaving equipment for \$60,000. It is expected to depreciate at an average rate of 10% per year.

 - a. Write an equation for the value of the piece of equipment after t years.
 - b. Find the value of the piece of equipment after 6 years.

- 5. FINANCES** Kyle saved \$500 from a summer job. He plans to spend 10% of his savings each week on various forms of entertainment. At this rate, how much will Kyle have left after 15 weeks?

- 6. TRANSPORTATION** Tiffany's mother bought a car for \$9000 five years ago. She wants to sell it to Tiffany based on a 15% annual rate of depreciation. At this rate, how much will Tiffany pay for the car?