Exam Review Part 3 – Exponential Functions
MCR3U
Jensen

Section 1: Exponential Growth

1) An insect colony as an initial population of 15. The number of insects quadruples every day.

a) Determine a function that models this exponential growth.

b) How many insects will be present in 1 week?

2) If the population of an ant colony is 213 and it doubles every week,

a) What will the population be in 4 weeks?

b) How long will it take the population to reach 109 056 ants?

3) The population of a town in the Northwest Territories starts off at 20,000 and grows by 13% each year. Find the populations after 10 years.

4) There are 50 bacteria present initially in a culture. In 3min., the count is 204800. What is the doubling period?

5) A bacteria culture starts with a population of 12 000 and doubles every four hours.

a) How many bacteria are present after 12 hours?

b) How many bacteria are present after 1 day?

c) How long will it take for the population of the bacteria to reach 49 152 000?

6) A bacteria culture doubles every 15 minutes. There were 20 individuals initially.

a) How many bacteria will be present after 3 hours

b) How long will it take to grow a population of 163 840?

Section 2: Exponential Decay

7) In 1976, a research hospital bought half of a gram of radium for cancer research. Assuming the hospital still exists, how much of this radium will the hospital have in the year 6836, if the half-life of the radium is 1620 years?

8) Polonium-210 is a radioactive isotope that has a half-life of 20 days. Suppose you start with a 40-mg sample.

a) Write an equation that relates the amount of polonium-210 remaining and time.

b) How much polonium-210 will remain after 10 weeks?

c) How long will it take for the amount of polonium-210 to decay to 8% of its initial mass?

9) A cup of coffee contains approximately 96 mg of caffeine. When you drink the coffee, the caffeine is absorbed into the bloodstream and is eventually metabolized by the body. Every 5 hours the amount of caffeine present in the body is reduced by one-half. How many hours does it take for the amount of caffeine to be reduced to 12 mg?

10) Daniel is very excited about his new motorcycle. Although the motorcycle costs $13 500, its resale value will depreciate by 20% of its current value every year.

a) How much will the motorcycle be worth in 6 years?

b) How long will it take for Daniel's motorcycle to depreciate to 50% of its original cost?

Section 3: Interest

11) An investment opportunity is found that makes 7% per year compounded annually. How much should you invest now if you need $13, 450 at the end of 9 years?

12) Jacqueline deposits an inheritance of $1500 into an account that earns interest of 3.5% per year, compounded annually.

a) How much is in the account after 8 years?

b) How long will it take for the money to double (round to the nearest year)?

13) Five years ago, Denise deposited an amount into an account that pays 7.5% per year, compounded annually. Today the account balance is $4200.

a) What was the amount of Denise's initial deposit?

b) How much was in the account 2 years ago?

c) How much will be in the account 2 years from now?

Section 4: Properties of Exponential Functions and Transformations
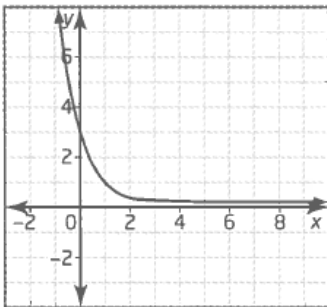
14) Match each graph with its corresponding equation

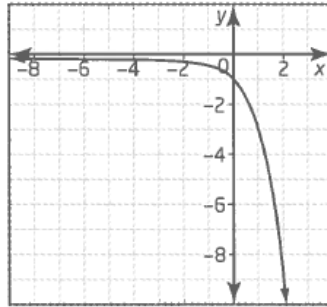**A** $y = 3(3^x)$

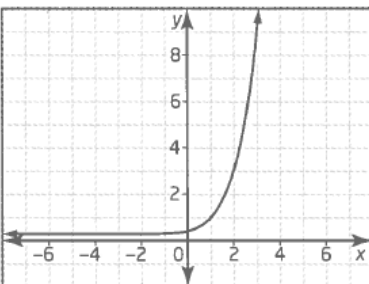**B** $y = 3\left(\frac{1}{3}\right)^x$

C $\frac{1}{3}(3^x)$

D $y = -3^x$

a) ____
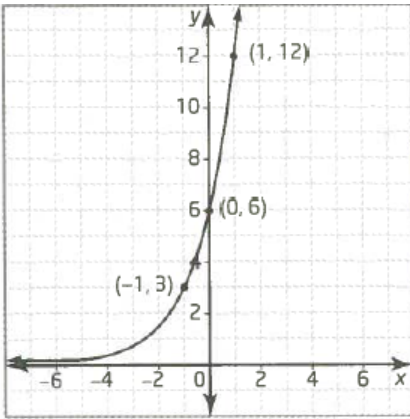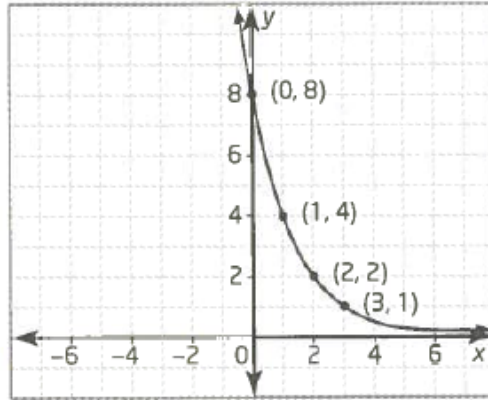

b) ____

c) ____

d) ____
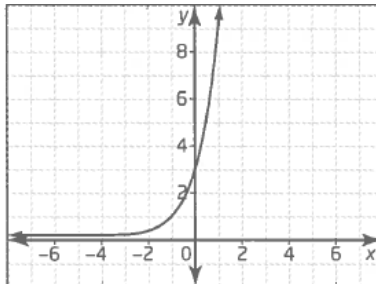
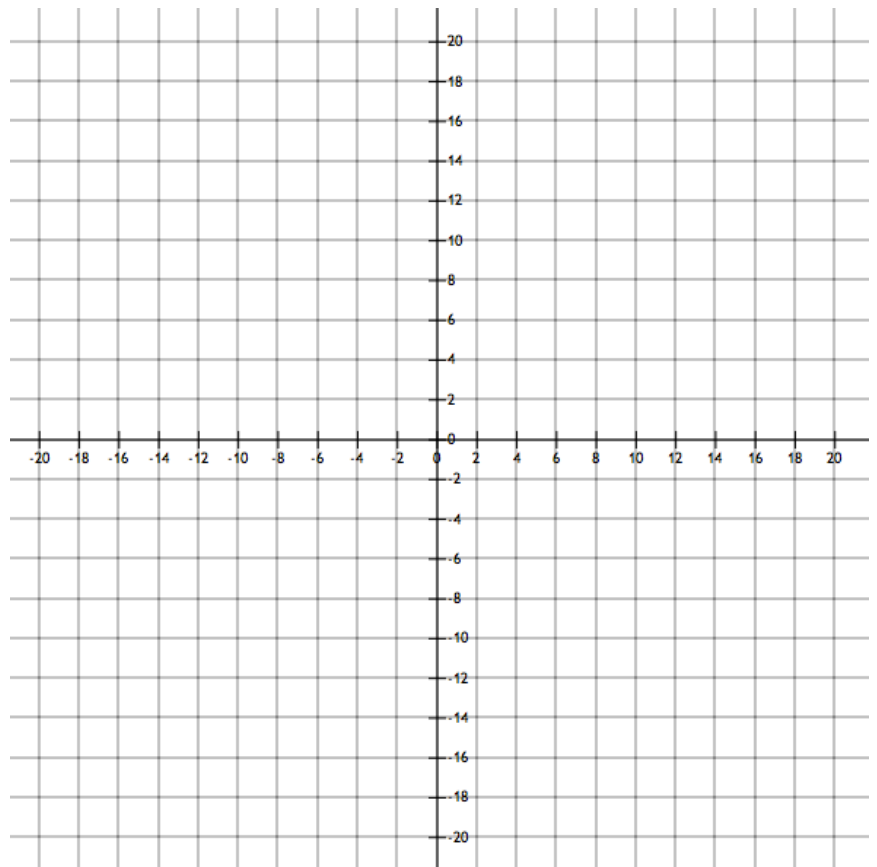**15)** Write an exponential equation to match each graph.

a)

b)

16) Sketch the graph base graph of $f(x) = -2\left(\frac{1}{2}\right)^{x+1} - 2$ and use transformations to graph f(x). Is this an increasing or decreasing function?

Answers

1) a) $P(n) = 15 \times 4^n$ **b)** 245 760

2) a) 3408 **b)** 9 weeks

3) 67 891

4) 15 seconds

5) a) 96 000 **b)** 768 000 **c)** 2 days

6) a) 81 920 **b)** 195 minutes

7) 0.0625 g

8) a) $f(t) = 40\left(\frac{1}{2}\right)^{\frac{t}{20}}$ **b)** 3.54 mg **c)** approximately 73 days

9) 15 hours

10) a) \$3538.94 **b)** 3.1 years

11) \$7315.91

12) a) \$1975.21 **b)** approximately 20 years

13) a) \$2925.55 **b)** \$3634.40 **c)** \$4853.63

14) a) B **b)** D **c)** C **d)** A

15) a) $y = 6(2^x)$ **b)** $y = 8\left(\frac{1}{2}\right)^x$

16) See posted solutions