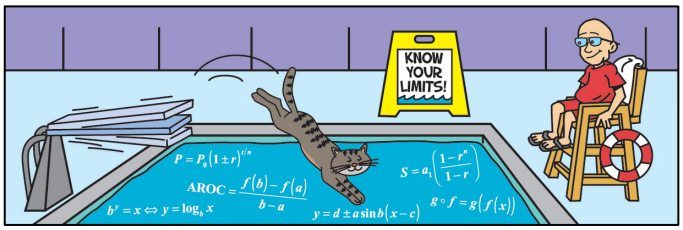
Diving In

AP Precalculus



2.1) Arithmetic Sequences (No Calculator)

1. An arithmetic sequence defined explicitly is $a_n = (n-1)^2$. Which of the following is the same function defined recursively?

A) $a_1 = 0$, $a_n = a_{n-1} + n^2$

B) $a_1 = 0$, $a_n = a_{n-1} + (n-1)^2$

C) $a_1 = 0$, $a_n = a_{n-1} + 2n - 1$

D) $a_1 = 0$, $a_n = a_{n-1} + 2n - 3$

2. $\sum_{i=1}^{5} (-1)^{i+1}(i^3 - 2i^2) =$

A) –24 B) 42 C) 51 D) 115

3. In an arithmetic sequence, the 10th term is 75 and the 50th term is 595. Find the 1st term.

A) –55 B) –42 C) –15 D) 0

4. Find the sum of the arithmetic sequence $-48 - 46\frac{1}{4} - 44\frac{1}{2} - 42\frac{3}{4} + \ldots + 64$

A) 508 B) 520 C) 528 D) 586

5. Let $a_{21} = 55, a_n = a_{n-1} + 7$.

a. Generate the terms a_{22} through a_{25}. **(1)**

b. Write an expression for the n^{th} term of sequence a_n. **(2)**

c. Find $\sum_{i=15}^{40} a_i$. Show how you arrive at your answer. **(3)**

d. If the sum of n terms of sequence a is greater than 10,000, write but do not solve an equation in terms of n. Express your equation with no fractions. **(2)**

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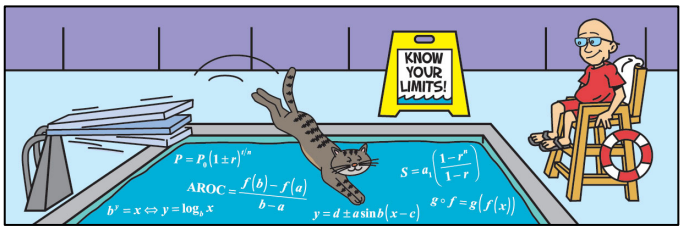

2.2) Geometric Sequences (Calculator Allowed)

1. If $a_1 = 11664, a_{k+1} = \frac{-2}{3}a_k$, find a_8

A) $\frac{4096}{9}$ B) $\frac{-4096}{9}$ C) $\frac{2048}{3}$ D) $\frac{-2048}{3}$

2. In a geometric sequence, $a_4 = 1000$ and $a_7 = 15625$. Find a_1

A) 32 B) 64 C) $\frac{25}{2}$ D) $\frac{32}{5}$

3. Find the sum of the first 50 terms of the geometric sequence 3, –3.3, 3.63, – 3.993, … (3 decimal accuracy).

A) 153.884 B) –185.900 C) –166.273 D) 3,491.726

4. Order these sums from largest to smallest value.

I. $\sum_{n=0}^{\infty} 80(0.25)^n$ II. $\sum_{n=1}^{\infty} 204\left(\frac{1}{3}\right)^n$ III. $\sum_{n=0}^{\infty} 190(-0.8)^n$

A) I, III, II B) II, III, I C) III, I, II D) II, I, III

5. A sequence is given $\{4096, -3072, ...\}$ but it is unknown whether the sequence is arithmetic or geometric.

a. Give the next term of the series depending on whether the series is arithmetic or geometric. **(2)**

b. Write the geometric sequence both recursively and explicitly. **(2)**

c. For what value of n is an element of the geometric sequence not an integer? **(1)**

d. Find the positive difference between the sum of the first 20 terms of the geometric sequence and the infinite sequence. **(2)**

e. Write but do not solve an inequality determining the value of n where the difference between the sum of n terms and infinite terms of the sequence is first less than 0.1. **(1)**

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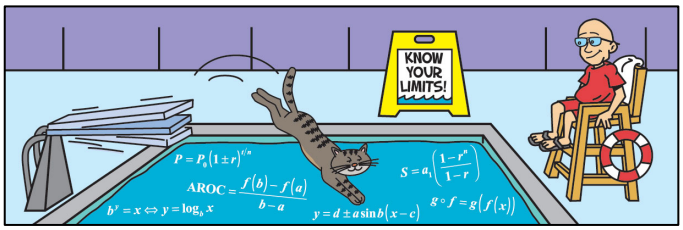

2.3a) Exponential Functions (No Calculator)

1. Which of the following is true about the graph of $y = 9\left(3^x\right)$?

   I. The graph of $y = 3^x$ is stretched vertically by a factor of 9.

   II. The graph of $y = 3^x$ is translated 2 units to the left

   A) I only B) II only C) Both I and II D) Neither

2. Let $f\left(x\right) = a^x, a > 1$. Which of the following creates a decay curve?

   I. $f\left(\frac{x}{a}\right)$ II. $f\left(-ax\right)$ III. $a - f\left(ax\right)$

   A) I only B) II only C) I and III only D) II and III only

3. Solve for x: $\left(\frac{1}{3}\right)^{x+4} = 3^{2x-3}$

   A) $\frac{-1}{3}$ B) -1 C) $\frac{2}{3}$ D) $\frac{7}{3}$

4. Find the product of the solutions to: $\frac{8^{x^2}}{256} = 4^x$

   A) 2 B) $\frac{-2}{3}$ C) $\frac{-3}{2}$ D) $\frac{-8}{3}$

5. Let $f(x) = -5^x$ and $g(x) = 4\left(\frac{4}{9}\right)^x$

a. In words, describe the transformation of $f(x-2)$ in terms of the graph of f in two different ways. **(2)**

b. In words, describe the transformation of $g\left(\frac{1}{2}x\right)$ in terms of g by comparing their behavior at their y-intercepts. **(1)**

c. Find the average rate of change of g between $x = -\frac{1}{2}$ and $x = \frac{1}{2}$. **(2)**

d. Explain why the graphs of f and the graph of g have no point of intersection. **(1)**

e. Find $f(x)g(x)$ and $\lim_{x\to-\infty}\left[f(x)g(x)\right]$ **(2)**

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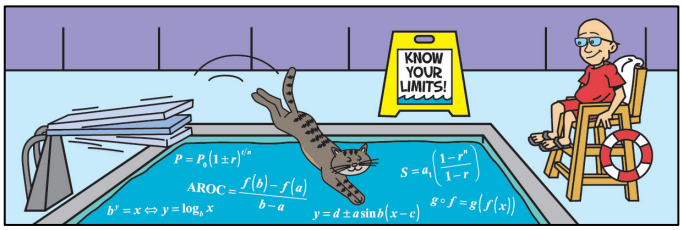

2.3b) Exponential Functions (Calculator Allowed)

1. If an exponential curve $f(x)$ passes though (2, 9) and (4, 4), what is $f(6)$?

A) 1 B) $\frac{8}{3}$ C) $\frac{16}{9}$ D) $\frac{256}{729}$

2. An exponential curve f passes through (5, 2) and (10, 72). For what integer value of k is $f(k)$ first greater than 10,000?

A) 16 B) 17 C) 24 D) 25

3. A function f is in the form $f(x) = ab^x$ and a function g is growing linearly with $h(x) = f(x) - g(x)$, $h(x) \geq 0$. If $h(k) = 0$, which of the following must be true?

I. $h(k+1) > h(k-1)$ II. $h(k+1) < h(k-1)$ III. $h(k+1) = h(k-1)$

A) I only B) II only C) Either I or II D) III only

4. A \$60,000 car depreciates in value. One year from now, its value is \$45,000. Find the difference in value in another 1.5 years if the depreciation is exponential as opposed to linear.

A) \$1,471 B) \$3,750 C) \$6,728 D) \$14,421

5. Felix and Oscar are both awarded money in a will. Felix is given $20,000 while Oscar is given $100,000. Felix invests his money while Oscar spends his. In 4 years, they both have $60,000. The amount of money each has is changing exponentially.

a. Find the equation that describes Felix's money over time. **(2)**

b. Find the equation that describes Oscar's money over time. **(2)**

c. Over the first 8 years, what is the maximum difference between Felix's money and Oscar's money? Show the reasoning that leads to your answer. **(2)**

d. How many years will it take for Felix to become a millionaire (3 decimal places)? **(1)**

e. How many years will it take for Oscar to have less than $1,000 (3 decimal places)? **(1)**

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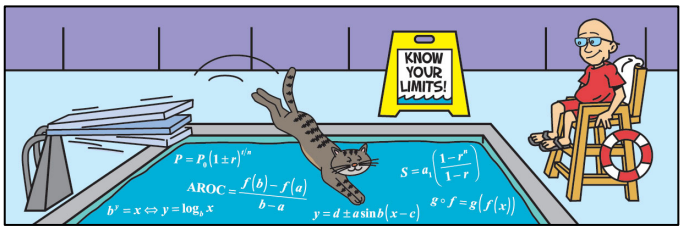

2.4) Composition of Functions (No Calculator)

1. Let $f(x)=15+3x-x^2$ and $g(x)=5x+4$. Which of these is smallest?

A) $(g\circ f)(-2)$ B) $(f\circ g)(-2)$ C) $(f\circ f)(-2)$ D) $(g\circ g)(-2)$

2. Suppose $f(x)=\dfrac{8}{x+3}$ and $g(x)=\dfrac{3}{3x+2}$, find the domain of $(f\circ g)(x)$.

I. $x\neq -2/3$ II. $x\neq -3$ III. $x\neq -1$

A) I and II only B) I and III only C) II and III only D) I, II and III

3. If $f(x)=\dfrac{x+1}{x-1}$ and $g(x)=\dfrac{x-1}{x+1}$, find $(f\circ g)(x)$

A) x B) $-x$ C) 1 D) does not exist

4. If $f(g(x))=\dfrac{2x}{16x^4+1}$ and $g(x)=4x^2$, find $f(x)$.

A) $\dfrac{2x}{4x^2+1}$ B) $\dfrac{\sqrt{x}}{4x^2+1}$ C) $\dfrac{2x}{x^2+1}$ D) $\dfrac{\sqrt{x}}{x^2+1}$

5. You have two coupons at an online website that sells merchandise. 1) Save 25% off your next purchase and 2) Take $50 your next purchase. It is possible that more than one coupon be used on a sale. All sales pay 5% of the prices for shipping with minimum shipping charges of $10. Let x be the total price of all items in your cart.

a. Write function f which represents the price of your cart when only the first coupon is applied. **(1)**

b. Write function g which represents the price of your cart when only the second coupon is applied. **(1)**

c. Write function h which represents the price of shipping. **(1)**

d. Find the value of $h\left(f\left(g\left(330\right)\right)\right)$ and explain its meaning. **(2)**

e. Find the value of $h\left(g\left(f\left(330\right)\right)\right)$ and explain its meaning. **(2)**

f. Explain the meaning of $\left|\left[f\left(g\left(x\right)\right)+h\left(f\left(g\left(x\right)\right)\right)\right]-\left[g\left(f\left(x\right)\right)+h\left(g\left(f\left(x\right)\right)\right)\right]\right|$ **(1)**

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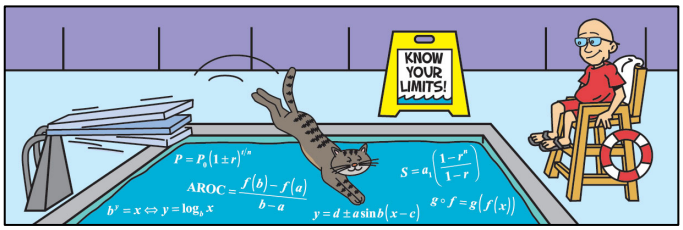
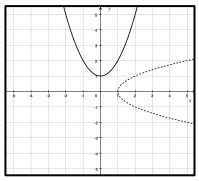
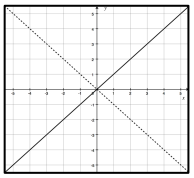
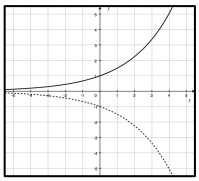


2.5) Inverses (No Calculator)

1. The following choices contain a solid curve f and a dashed curve g. In which is f and g both functions and $g = f^{-1}$?

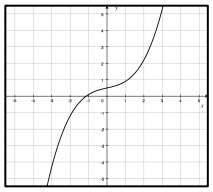
A) 

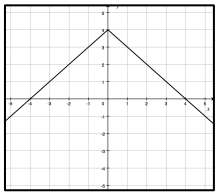
B) 

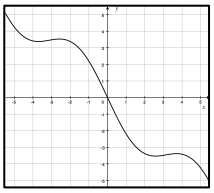
C) 

D) None of these

2. Which functions are one-to-one?

I. 

II. 

III. 

A) I only

B) II only

C) I and III only

D) I, II and III

3. The choices below are real-life examples of functions. In how many of them is the inverse also a function?

I. In a math class, each student has the same teacher.
II. Each person has a set of fingerprints.
III. Each person has a passport.
IV. On a ship, a person can be assigned to only one stateroom.

A) 1

B) 2

C) 3

D) 4

4. If $y = \dfrac{3x-2}{2x+3}$, find its inverse.

A) $y = \dfrac{3x+2}{2x-3}$

B) $y = \dfrac{2x+3}{3x-2}$

C) $y = \dfrac{2x-3}{3x+2}$

D) $y = \dfrac{3x+2}{3-2x}$

5. Let $f(x)=\sqrt{2x+2}$ and $g(x)=4x-1$

a. Find the domain and range of f. **(1)**

b. Find $f^{-1}(x)$ and any restrictions such that f is a one-to-one function. **(2)**

c. Find $g^{-1}(x)$ **(1)**

d. Find $\left(f^{-1}\circ g^{-1}\right)$ at $x = 15$ **(2)**

e. Find $(f\circ g)^{-1}(12)$ **(2)**

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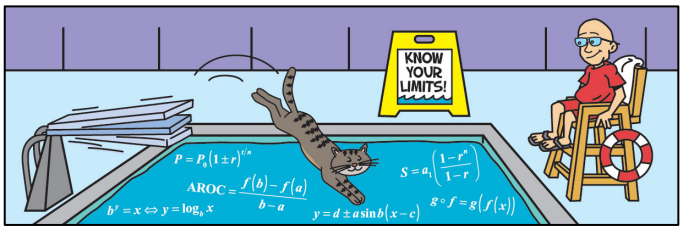

2.6a) Logarithms (No Calculator)

1. Find $\log_4 128 + \log_9 \frac{1}{243}$

A) 6 B) 1 C) 0 D) –1

2. Solve for x: $\log_3(3x+3) = 6^{\log_6 3}$

A) 8 B) 3 C) 2 D) $\frac{-2}{3}$

3. Place these in descending order:

I. $1 - \log\frac{1}{1000}$ II. $8\log\sqrt[3]{100}$ III. $\left(3\log\frac{\sqrt{10}}{10}\right)^2$

A) II, I, III B) III, II, I C) II, III, I D) I, III, II

4. $\frac{\ln\sqrt{e} - \ln\sqrt[3]{e^2}}{e\ln e^2}$

A) $\frac{-1}{2e^2}$ B) $\frac{-1}{12e^2}$ C) $\frac{-1}{2e}$ D) $\frac{-1}{12e}$

5. Let $f(x) = -10^x$ and $g(x) = e^x$

a. Write a function h that represents the reflection of f across the x-axis followed by a translation 3 units to the right. Find the distance between the point $(0, f(0))$ and its translated point. **(2)**

b. Find $h^{-1}(x)$. **(1)**

c. Show that $h(h^{-1}(x)) = h^{-1}(h(x)) = x$ **(2)**

d. Write a function j that represents g vertically stretched by a factor of ½ and shifted 2 units to the left. **(1)**

e. Find $j^{-1}(x)$. **(1)**

f. Show that $j^{-1}(j(x)) = x$ **(1)**

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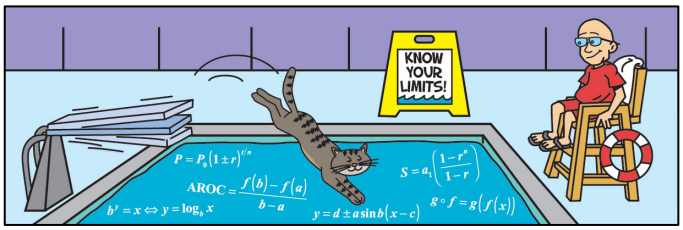


2.6b) Logarithms (Calculator Allowed)

1. If $f(x) = 2(10^{x-1}) - 1$, find the average rate of change of $f^{-1}(x)$ on [1, 19].

A) $\frac{1}{6}$ B) $\frac{3}{19}$ C) $\frac{1}{18}$ D) $\frac{1}{19}$

2. In a community, people's net worth are recorded. Because of the great variation in net worth, people are tracked by the value v in the equation $\text{Net Worth} = 10^v$. The poorest person in the community has a net worth of \$75,000 and $v = 4.88$. The richest person in the community has a net worth of \$3.5 million with $v = 6.55$. If Elon Musk moves into the community whose net worth is \$11.28 billion, what is his v-value?

A) 9.28 B) 10.05 C) 10.28 D) 11.28

3. I am training to run a half-marathon (13.1 miles). I was told that because of possible injury, not to increase my running distance by more than 10% each week. Every week I write out my running goals. If I currently run 5 miles, how many weeks in the future do I project before I can run the half-marathon distance?

A) 10 B) 11 C) 16 D) 17

4. An experiment involved men 60 – 65 years old with a high PSA level (that could indicate cancer) in the blood. They took statin medication to reduce the PSA number and found that it reduced by 5% a month. If a man had a PSA value of 8, how many months will it take to reduce the PSA level by 25%?

A) 5.6 B) 6.2 C) 10.5 D) 27.0

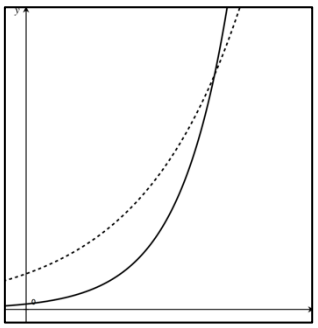
5. When a quantity Q is growing continuously at a rate r per unit time t, its equation is $Q = Q_0 e^{rt}$ where Q_0 is the initial quantity.

a. Show that the amount of time it takes Q to double is $\frac{\ln 2}{r}$. **(1)**

b. If the earth's population is increasing at 1.14% yearly, how many years will it take to double? **(1)**

c. In a wooded area, there are two types of rabbits. Ones with light brown fur have a current population of 300 and its population doubles every 1.2 years. The other have dark brown fur with a current population of 2,000 and its population doubles every 2.4 years. Find the rate of growth for both rabbits (3 decimal places). **(2)**

d. Shown to the right is a graph of the growth rate of both rabbits without a scale. What are the equations generating the graphs? **(2)**



e. Duplicate this graph on your calculator in order to find the number of years it will take for the populations to be the same and what that population is. **(2)**

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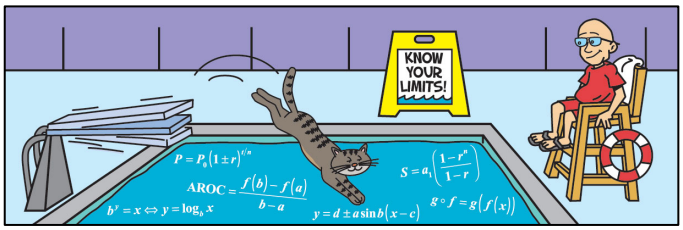

2.7a) Operations with Logarithms (No Calculator)

1. Find $\left(\log_5 50\right)\left(\log_{50} 10\right)$

A) $\log 2$ B) $\dfrac{1}{\log 5}$ C) $\log_{250} 500$ D) 5

2. Given that $x = \log 2$, $y = \log 3$, and $z = \log 7$, express $\log\dfrac{12000}{7}$ in terms of x, y and z.

A) $\dfrac{2x+y}{z}+3$ B) $\dfrac{x^2+y+3}{z}$ C) $2x+y-z+3$ D) $x^2+y-z+3$

3. Which of the following is equivalent to $\dfrac{1}{3}\left[\log_4\left(x^3-8\right)-\log_4 x^3\right]$?

A) $\log_4\left(1-\dfrac{2}{x}\right)$ B) $\log_4\left(1-\dfrac{8}{x^3}\right)$ C) $\log_4\dfrac{x-2}{x}$ D) $\log_4\dfrac{\sqrt[3]{x^3-8}}{x}$

4. Find the sum of the zeros of the function $f\left(x\right)=\log_3\left(3x+6\right)+\log_3\left(x-4\right)-4$.

A) 2 B) 6 C) 7 D) 12

5. For each equation, use appropriate log rules to simplify and solve.

a. $\log_2 \sqrt{x^2 - 6x} = 2$ **(3)**

b. $\log_6 4 + \log_6 (x+2) - \log_6 x = 2$ **(2)**

c. $\ln x - \ln(x+3) = -2$ **(3)**

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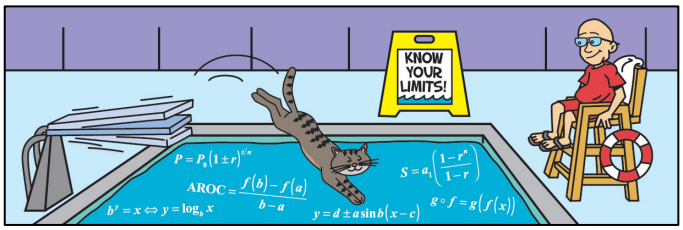

2.7b) Operations w/Logarithms (Calculator Allowed)

1. If $8^{x-2}=10$, what is the value of 2^x?

A) 1.270 B) 8.618 C) 4.278 D) 0.539

2. Solve for x: $8^{2x-1}=5^{x+5}$

A) $\dfrac{\log 8-5\log 5}{2\log 8+\log 5}$ B) $\dfrac{6}{2\log 8-\log 5}$ C) $\dfrac{5\log 40}{2\log 3}$ D) $\dfrac{\log 8+5\log 5}{2\log 8-\log 5}$

3. If a is a positive constant, solve for x: $a^{4x}-2a^{2x}=48$

A) $\dfrac{\log 8}{2\log a}$ B) $\dfrac{\log 4}{\log a}$ C) $\dfrac{1}{2}\log\left(\dfrac{8}{a}\right)$ D) $\dfrac{1}{2}\log(8-a)$

4. If an exponential curve f passes through (0, 4) and (5, 6), find $f(12)$.

A) 8.800 B) 10.585 C) 12 D) 15.877

5. Jerry is on a 2-month (60-day) vacation. On day 10, he isn't feeling well and goes to an off-the street medical facility. It is found that his blood sugar number is high. It is measured at 180 mg/dL which is pre-diabetic. The doctor prescribes him to manage his diet carefully and take Metformin and return in 2 weeks. His blood sugar number came down to 160 mg/dL. The day after he returns from vacation, he plans to see his regular doctor for a full check-up.

   a. Using a linear model, predict his blood sugar (nearest whole number) when he visits his doctor. **(2)**

   b. Using an exponential model, predict his blood sugar (nearest whole number) when he visits his doctor. Show the analysis that leads to your answer. **(3)**

   c. Using the exponential model, on what vacation day would you predict his blood sugar gets down to 140? Round to nearest day. Show your analysis. **(3)**

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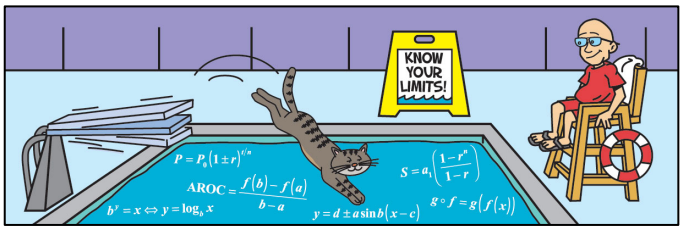


2.8a) Exponential Models (No Calculator)

1. A quantity Q is increasing by 200% every 3 months. Write an expression that describes how the size of Q in t years.

A) $Q(2)^{t/4}$ B) $Q(2)^{4t}$ C) $Q(3)^{t/4}$ D) $Q(3)^{4t}$

2. The population of a bunch of feral cats is 50 and is increasing at the rate of 2% every month. Animal activists want to have a formula that describes the number of months m it would take the population to reach any number P. Which of the following calculates m?

A) $m=\log\left(\frac{P}{50}\right)-\log 1.02$

B) $m=\frac{\log P-\log 50}{\log 1.02}$

C) $m=\frac{\log(P-50)}{\log 1.02}$

D) $m=\log\left(\frac{P-50}{1.02}\right)$

3. A truck driver drinks two 8-oz cups of coffee to stay awake, each containing 90 mg of caffeine. The half-life of caffeine is 5 hours. Write an expression that gives the number of hours it takes for the amount of caffeine in his bloodstream to be at or below 30 mg.

A) $\frac{5\log 6}{\log 2}$ B) $5\log 3$ C) $\frac{\log 6}{5\log 2}$ D) $5\log 1.5$

4. Which of the following is an expression predicting the length of time t for a sum of money S to triple at 4% annual interest compounded quarterly?

A) $t=\frac{\log(3/1.01)}{4}$ B) $t=\frac{\log 3}{4\log 1.01}$ C) $t=\frac{\log 3}{\log 1.04}$ D) $t=4(\log 3-\log 1.04)$

5. I have a gift card in the sum of $500. However, the fine print on this card says that it loses value for every day you do not spend it.

   a. Suppose it loses 2% of its value annually. Write expressions that represent the amount of money the card loses in 2 years if that amount is compounded i) annually, ii) daily, iii) continuously. **(3)**

   b. Would you expect the three answers in part a to be close to each other or far apart? Explain. **(1)**

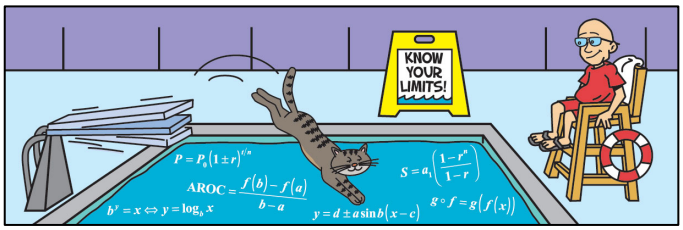
   c. Without calculating, determine which of i, ii, or iii is the greatest and why. **(1)**

   d. Suppose the card loses 2% of its value i) quarterly, ii) monthly. Write expressions that represent the value of the card in two years in each case. **(2)**

   e. Would you expect the two answers in part d to be close to each other or far apart? Explain. **(1)**

Diving In

AP Precalculus



2.8b) Exponential Modeling (Calculator Allowed)

1. A bank website announces at 11 AM that there will be an emergency shutdown of service for maintenance for a duration of one hour starting at 1 PM. At 11 AM, 75 people are aware of it and that number quadruples every 20 minutes. How many people will be aware of the planned shutdown when it occurs?

   A) 54,675 B) 76,800 C) 307,200 D) 1,171,875

2. A piece of land in a city was purchased for $200,000. Because the area is in a slum, the value of the land is decreasing by 2.5% a year. 4 years pass and the area begins to be fixed up and the value of the land then increases by 1.5% a year. In how many years total will the land again be worth $200,000?

   A) 6.8 B) 8.4 C) 9.4 D) 10.8

3. My doctor tells me that taking an antidepressant with a longer half-life means fewer withdrawal problems. Taking Prozac, it takes approximately 21.5 days for the drug's active ingredient in the bloodstream to reduce from 100% to 5%. What is the half-life of the drug?

   A) 3.8 days B) 4.4 days C) 5.0 days D) 5.8 days

4. I have a choice of investing a sum of money at different rates of interest and compounding methods. Arrange the following in the order it will take my money to double from fastest to slowest.

   I. 2.11% annually II. 2.1% quarterly III. 2.09% continuously

   A) I, II, III B) II, I, III C) III, I, II D) II, III, I

5. The Baldwin Estate stipulates that upon the son Geoff reaching the age of 30 years old, he is to receive $1,000,000, assuming that he has never been in any trouble with the law. The estate was re-structured when Geoff was 15 years old and Geoff's trust was invested in an account gaining 4.5% interest annually, compounded monthly.

   a. How much money was invested in Geoff's account in order for him to receive his money at age 30? Show your analysis. **(2)**

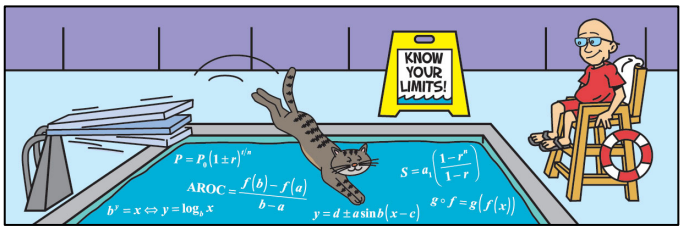
   b. How much money less money could have been invested if the money was compounded daily? **(2)**

   c. Well before his 30th birthday, Geoff needs cash for Christmas presents and borrows $1,000. He has 65 days to pay back the money along with a $310 finance charge. What annual interest rate is he paying if the money is compounded continuously? **(2)**

   d. Geoff at his 29th birthday is broke and goes to a loan shark to borrow $50,000 to get him through the year. The loan shark makes the deal because of the collateral of Geoff's inheritance at his 30th birthday. The loan shark charges 5.5% interest a week, compounded continuously. How will paying off the loan shark on Geoff's 30th birthday affect his inheritance? **(2)**

Diving In

AP Precalculus



2.9) Regression (Calculator Allowed)

1. The manager of a used-car lot determines that if y is the year of the vehicle with $y < 2023$, the average price of a car on the lot is given by $P(y) = 21525 - 925(2023 - y)$ with the cheapest car on the lot being a 2005 Nissan at \$4,500. Which is a correct interpretation?

   I. For every year older, the price decreases by \$925. II. The line describing this goes down to the right.
   III. The residual for the Nissan is \$375.

   A) I only B) II only C) I and III only D) II and III only

2. A bear is given a tranquilizer in order for it to be cared for. The table to the right gives the amount of milligrams m of medication remaining in the bear's bloodstream based on hours h. Describe the most likely relationship $m(h)$.

h	0	0.5	1	1.5	2
m	275	238	206	176	150

   A) Logarithmic B) Linear C) Exponential D) Quadratic

3. Uber has been in business since 2016. Its total monthly active users every 6 months is given in the table to the right. A logarithmic model is used to predict its users for the year 2020. Because of the company Lyft first starting to compete in 2020, Uber had "only" 148 million users. How far off was the model's prediction?

Year (half)	2016(1)	2016(2)	2017(1)	2017(2)	2018(1)	2018(2)	2019(1)	2019(2)
Users (millions)	44	78	106	150	146	184	192	214

   A) 17.0 million B) 19.5 million C) 145.5 million D) 184.6 million

4. A forest fire not tended to is destroying trees exponentially. The table to the right gives the percentage of the forest's trees that are *not destroyed* over a period of a week. What percent of the forest is still intact after 2 weeks?

Day	1	2	3	4	5	6	7
% not destroyed	98.5%	98.0%	97.3%	96.4%	95.1%	93.4%	91.0%

   A) 25.5% B) 47.8% C) 73.5% D) 74.5%

5. A publication company is planning to create a small magazine for residents in a particular area. They wish to get a sense of how many people would subscribe based on the yearly cost. Following is a table showing the price for a subscription and the number of people who would subscribe based on a survey.

Price $	5	10	15	20	25
Subscribers	1460	1325	1230	1100	970

a. The company is interested in their projected revenue based on the projected number of subscribers. Complete the table. **(1)**

Price $	5	10	15	20	25
Subscribers	1460	1325	1230	1100	970
Revenue $					

1 pt for completing table

b. Create a linear model for revenue as a function of price and use it to predict the revenue if the price of a subscription is $40. **(2)**

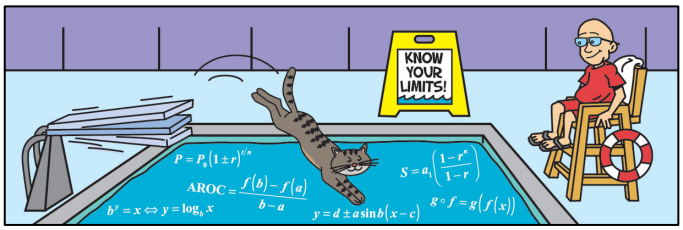
c. Create a quadratic model for revenue as a function of price and use it to predict the revenue if the price of a subscription is $40. **(2)**

d. Create a logarithmic model for revenue as a function of price and use it to predict the revenue if the price of a subscription is $40. **(2)**

e. Determine which model makes sense in the real-world and give a reason. **(1)**

Diving In

AP Precalculus

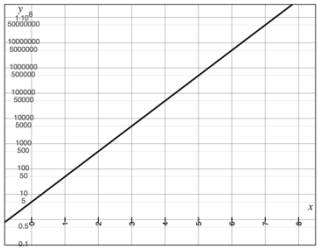


2.10) Semi-Log Plots (Calculator Allowed)

1. Which of the following relationships would best be shown using a semi-log plot?

A) Volume of a planet vs. its distance from sun
B) Diameter of a tree vs. its height
C) Price of husband's car vs. price of wife's car
D) Diameter of red blood cells vs. white blood cells

2. The graph of x vs. y is shown to the right using a semi-log plot. Order the following average rates of change from largest to smallest.



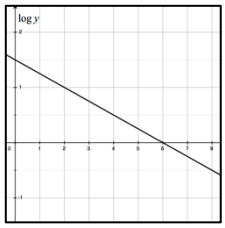
I. $x = 2$ and $x = 3$ II. $x = 5$ and $x = 6$ III. $x = 2$ and $x = 6$

A) II, III, I
B) III, II, I
C) III is largest and I and II are smaller and equal
D) All the same

3. If $y = 15\left(5^{-x}\right)$ was to be graphed so it can easily be shown on Cartesian axes, its equation is

A) $\log y = -x\left(2\log 5 + \log 3\right)$
B) $\log y = x\left(2\log 5 - \log 3\right)$
C) $\log y = \log 3 + \left(x-1\right)\log 5$
D) $\log y = \log 3 + \left(1-x\right)\log 5$

4. Given the graph of $\log y$, generate the exponential equation in the form $y = ab^x$.

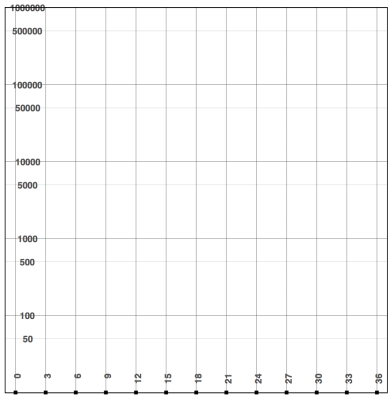


A) $y = \left(\dfrac{1}{10^{2.5}}\right)^x$
B) $y = \left(10^{1.25}\right)^x$
C) $y = 10^{1.5}\left(\dfrac{1}{\sqrt[4]{10}}\right)^x$
D) $y = 10^{1.5}\left(\sqrt[4]{10}\right)^x$

5. A newly constructed neighborhood with single family homes as well as condos has 20 houses to start but grows quickly according to the following table.

months	3	6	9	12	24
houses/condos	42	90	190	402	8068

a. Plot the points on the semi-log graph to the right with the horizontal being time in months and the vertical being houses/condos. **(2)**



b. Explain why the function representing house/condos as a function of time is exponential by referring to the graph of the function. **(1)**

c. Since the data is exponential, there is a common ratio r between data points. Find its value accurate to one decimal place. **(1)**

d. Write the function h that predicts the number of houses/condos based on the number of months m. **(2)**

e. Find the residual for $m = 24$. **(2)**