Name: ______________________

IAG 1 Skinny

Midterm Exam

Review Packet

Answers to Some Commonly Asked Questions:

- This exam is over the *entire* semester.
- You get a 3x5 notecard, front and back, to use on the exam. This card will be provided by Ms. H and turned in with the midterm. You will not be provided with any equations on the actual test.
- Roughly 75% of the questions on the final come from old tests, quizzes, and review packets. The numbers in the problems will be changed.
- You have an hour and a half to take the exam.
- This is NOT a multiple choice exam—the format of the exam is the same as all the other tests you have taken in IAG 2 this year.
- How to study—PRACTICE, over and over and over! Start by re-reading all the notes (found under the "Note" tab in the binder), work on the Midterm Exam Review Packet you are given, identify your areas of weakness, then find the quizzes and tests that correspond to these topics. Re-do the problems on a separate sheet of paper and check your answer against the original answer. Do NOT simply "look over" a problem—this is a waste of your time and is not an effective way to study. If you do not have the correct answer written down on the original paper, see Ms. H.
- Good luck!

Unit 1 –Functions

1. State the theoretical domain and range of each of the functions below.

a) $f(x) = 4x + 6$

D: All reals
R:

b) $h(x) = \frac{7}{x}$

D: $x \neq 0$

R: $y \neq 0$

To graph this, go to y =, Math, NUM, 1: abs(, press enter and then type in the x!

c) $g(x) = \sqrt{5x}$

D: $x \geq 0$

R: $y \geq 0$

d) $f(x) = |x|$

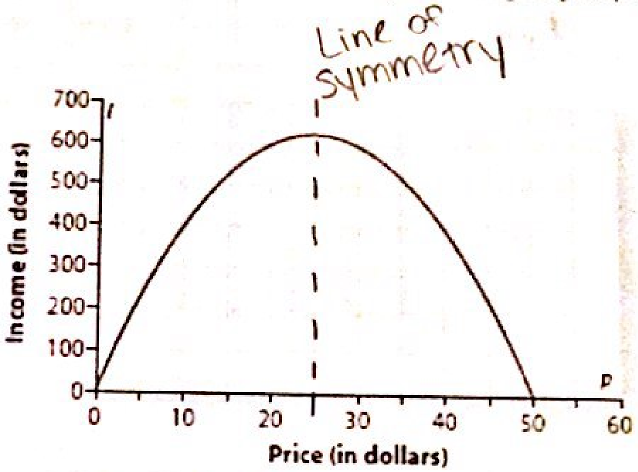
D: All reals

R: all positives + 0 (or $y \geq 0$)

2. The following graph shows how the income from an amusement park bungee jump I(p) is related to ticket price p.

a) Is the function increasing, decreasing or both?

Both



b) What does the maximum point tell you about the amusement park bungee jump?

The max income is \$625, and happens when ticket price is \$25

c) Does this function have any x-intercept(s)? If so estimate the point(s).

yes, at (0,0) and (50,0)

d) Does this function have a y-intercept? If so estimate the point.

yes, at (0,0)

e) Is the graph of this function symmetrical? If so, draw in a dashed line where the line of symmetry would be located—please do so with ink or a highlighter

yes!

f) What is the practical domain of this function? \$0 to \$50

g) What is the practical range of this function? \$0 to \$625

3. Solve the following inequality **algebraically**: $-3x - 5 < 25$

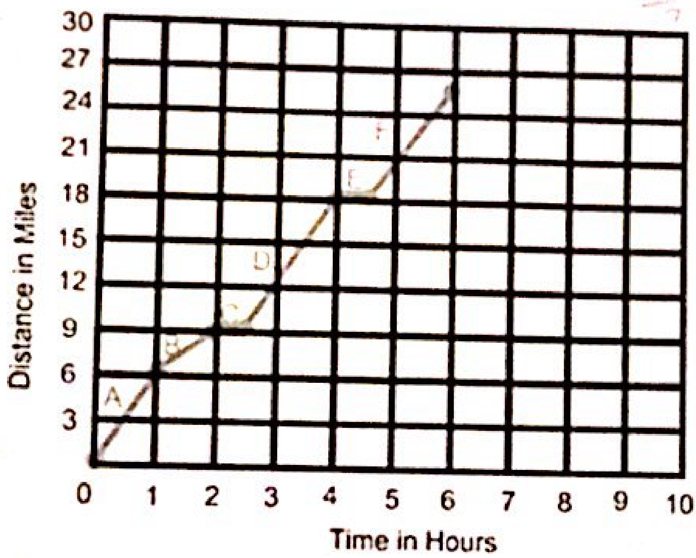
$$-3x - 5 < 25$$
$$+5 \quad +5$$
$$-3x < 30$$
$$\frac{-3x}{-3} \quad \frac{30}{-3}$$

FLIP SIGN! $\boxed{x > -10}$

4. Solve for x in the following equation **algebraically**: $6(x - 4) = -4x + 3(x + 6) - 14$

$$6x - 24 = -4x + 3x + 18 - 14$$
$$6x - 24 = -1x + 4$$
$$+1x \qquad +1x$$
$$7x - 24 = 4$$
$$+24 \quad +24$$
$$7x = 28 \rightarrow \boxed{x = 4}$$

5. The following graph represents Karen's marathon.



a) What are the units for the average rate of change?

SLOPE $\quad \frac{\Delta y}{\Delta x} \quad \frac{\text{miles}}{\text{hour}}$

b) What is the rate of change for interval A? (Don't forget to include the units!)

Start (0,0)
End (1,6)

$$\frac{y_2 - y_1}{x_2 - x_1} \quad \frac{6-0}{1-0} = 6 \text{ mi/hr}$$

c) Which interval has a greater rate of change, interval B or interval D? Explain how you can tell just by looking at the graph.

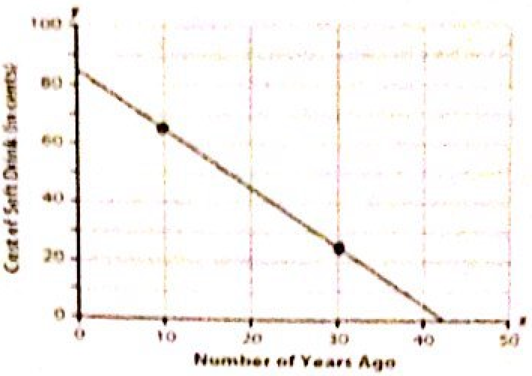
Interval D because the slope is steeper (which means larger rate of cha

d) What is the average rate of change for interval C? Explain what you think may have happened during this interval.

0 mi/hr

She must have stopped for a few minutes

8. The graph below displays how the cost of a 12-ounce soft drink changes as year changes.



a. Find the slope of the line.

m=2 (10,65) (30,25)

$\frac{65-25}{10-30} = \frac{40}{-20} = -2$

b. Write a Now-Next equation that would model the line. Don't forget a 'starting at' value!

Next = NOW − 2 Starting at 85

c. Let x = number of years ago and y = cost of soft drink. Write an equation relating x and y.

$y = -2x + 85$

Unit 2 (Part II) – Exponential Functions

9. Radioactive materials have many important uses in the modern world, from fuel for power plants to medical x-rays. Radioactive materials also can be very dangerous - for example it can cause cancer. The radioactive chemical strontium-90 is produced in many nuclear reactions. Extreme care must be taken in transportation and disposal of this substance. It decays very slowly - if any amount is stored at the beginning of a year, 98% of that amount will still be present at the end of the year.

a. If 225 grams of strontium-90 are released due to an accident, how much of that substance will still be around after 1 year? After 3 years?

225 * 0.98 = 220.5gr after 1yr

211.8gr after 3yr

b. Write a NEXT-NOW equation that can be used to calculate the amount of strontium-90 remaining after any number of years.

Next = NOW • 0.98 Starting at 225

amount remaining

c. Write an equation in the form $y = a \cdot b^x$ that can be used to calculate the amount of strontium-90 remaining after x number of years.

$$y = 225(0.98^x)$$

e. How long is the **half-life** of strontium-90? That is, how long until half of the original amount remains? Explain how you found your answer.

$225 \div 2 = 112.5$

In table, $y = 112.5$ when $x \approx 34$ or 34.5 yrs

d. How long will it take for there to be less than 2 grams of strontium-90?

$y < 2$ when $x = 234$ years

(used table)

10. Suppose that your grandparents starting a savings account for you when you were born. Your grandparents put $5000 into a savings account that pays 7% interest annually.

a. Write an equation in the form $y = a \cdot b^x$ that models this situation.

$$y = 5000(1.07^x)$$

b. Use your equation to fill in the below table.

Yrs since birth	0	1	2	7	12	16	20
Value of account	$5,000	5350	5725	8029	11,261	14,761	19,348

11. Algebraically, find an equation for an exponential function that passes through (2, 5) and (3, 20).

$$\frac{20 = \cancel{a}(b^3)}{5 = \cancel{a}(\cancel{b^2})} \rightsquigarrow 4 = b \quad \text{so} \quad 5 = a(b^2)$$

$$\frac{\cancel{a} \cdot \cancel{b} \cdot \cancel{b} \cdot b}{a \cdot b \cdot b}$$

$$5 = a(4^2)$$

$$5 = 16a$$

$$\frac{5}{16} = \frac{16a}{16}$$

$$.3125 = a$$

$$y = .3125(4^x)$$

12. Simplify the following using the Laws of Exponents. Use positive exponents in your final answer.

a) $z^0 = 1$

b) $\left(\frac{a}{b}\right)^6 = \frac{a^6}{b^6}$

c) $7x^{-4} = \frac{7}{x^4}$

d) $(2x^2)^3$

$= 2^3x^6$

$= 8x^6$

e) $(x^5y^2)(x^3y^4)$

x^8y^6

f) $\left(\frac{x^6y^5}{x^5y^3}\right)^3$

$(x^1y^2)^3$

x^3y^6

13. The following table gives the number of AIDS cases reported in the Los Angeles area for the years 1983 through 1988.

Years since 1983	0	1	2	3	4	5
Number of Aids Cases Reported	270	450	640	900	1300	1800

a) Use your calculator to find a regression equation for a linear model and for an exponential model. If necessary, round to three decimal places.

Linear Model: $y = 298.857x + 146.190$

Exponential Model: $y = 292.064(1.450^x)$

b) For your **exponential** model, explain what the growth factor means *in the context of the problem.*

1.450 means reported AIDS cases increases by 145% each year

c) Make a scatterplot of the data on your calculator. ***Based on the scatterplot and the data table***, which equation do you think best models the data [linear or exponential]?

I think it is a(n) exponential *model*

I can tell using the graph because. . . the graph is curved

I can tell using the table because. . . the y-values are not increasing at a constant rate

d) Using the model you choose in part c, when did the predicted number of Aids cases reach 1 million?

$y = 292.064(1.45^x)$

* using a table, $y = 1{,}000{,}000$ (or 1 E 6)

when $x = 22$ 22 years!

Unit 3 – Sequences and Population Change

14. Suppose that the current population of alligators in a particular region is 1,300. As a result of births and natural deaths, the population increases by 10% each year. Suppose that hunters are allowed to capture a total of 150 alligators each September.

a. Write the NOW-NEXT formula to model this situation.

Next = 1.10 NOW − 150 starting at 1300

b. How many alligators will there be 5 years from now?

Year	Alligator Population
0	1,300
1	1,280
2	1,258
3	1,233
4	1,207
5	1,177

15. In 2007, Nevada was the state with the fastest growing population. It had a population of approximately 2.57 million people and an annual growth rate of 2.9%.

a. Use the information to estimate the population of Nevada in 2008.

$2.57 * 1.029 = 2.64$ million

b. Consider the sequence of annual population estimates for Nevada. Is the sequence arithmetic, geometric, or neither?

Geometric

c. Determine a recursive and a function formula for the sequence of population estimates.

Recursive Formula: $a_n = a_{n-1} * 1.029$ with $a_0 = 2.57$

Function Formula: $a_n = 2.57(1.029^n)$

d. Predict the population of Nevada in 2027. $n=20$

$2.57(1.029^{20}) = 4.55$ million

16. The music department at Wilson High School operates a soft drink machine near the auditorium. The distributor comes monthly and empties the money from the machine. The music department earns $60 plus $4 per case sold.

a. The amount the music department earns each month depends on the numbers of cases sold. Fill in the table below.

Number of Cases Sold	0	1	2	3	4	5
Amount Earned	60	64	68	72	76	80

b. Is the sequence of monthly earnings arithmetic, geometric, or neither? Explain.

arithmetic – adding 4 each time

c. Determine the recursive and function formulas for the sequence of monthly earnings described above.

Recursive Formula: $a_n = a_{n-1} + 4$ with $a_0 = 60$

Function Formula: $a_n = 4n + 60$

d. How much will the music department earn in a month if 25 cases of soft drinks are sold? Explain or show your work.

$4(25) + 60 = 160$

e. During April, the music department made $208. How many cases of drinks were sold?

$208 = 4n + 60$

$-60 \quad -60$

$148 = 4n$

$\frac{148}{4} = \frac{4n}{4}$

$37 = n$

17. At the beginning of 2009, Erin borrowed $12,000 from a special student loan fund to help pay her way through college. The interest on the loan is 8% compounded annually.

a. Complete the table below, showing the amount to the nearest dollar Erin owes at the beginning of each year, assuming that she does not pay anything on the loan.

Year	Amount Owed (in dollars)
2009	$ 12,000
2010	$12,960
2011	$ 13,996.80
2012	$ 15,116.54

b. Consider the sequence of increasing amounts owed. Is this sequence arithmetic,, geometric, or neither? Explain how you can tell from the pattern in the table.

Geometric - multiplying

c. Write the NOW-NEXT, recursive, and function formula for the sequence of amounts that Erin owes.

Next = NOW * 1.08 starting at 12,600

Recursive: $a_n = a_{n-1} * 1.08$ with $a_0 =$ 12,600

Function: $a_n = 12{,}000(1.08^n)$ with $a_0 =$ 12,000