Instructor: **Grøndahl**

Name: Key

MATH 173
Unit Exam 2

Show All Work
Justify All Conclusions
No Graphing Calculators Allowed

You Got This

1) 4.1 #41
2) 4.2 #17
3) 4.3 #35
4) 4.4 #19
5) 4.5 #21
* 6) 5.1 #1
* 7) 5.1 #63
8) 5.2 #25
* 9) 5.3 #17
10) 6.1 #27
11) 6.2 #7
* 12) 6.3 #20

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1) Calculate the rate of change of $f(x) = 3^x$ over the intervals $0 \le x \le 1$, $1 \le x \le 2$, and $2 \le x \le 3$. What does this tell you about the concavity and why?

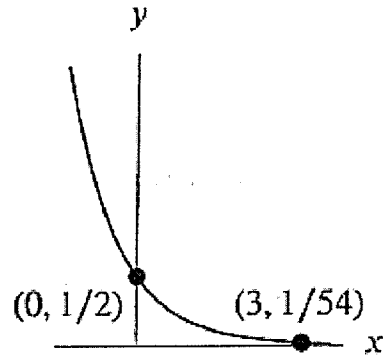
$[0,1]$ $\quad \frac{3-1}{1-0} = \frac{2}{1} = 2$

$[1,2]$ $\quad \frac{9-3}{2-1} = \frac{6}{1} = 6$

$[2,3]$ $\quad \frac{27-9}{3-2} = \frac{18}{1} = 18$

CONCAVE UP, SINCE RATE OF CHANGE IS INCREASING.

2) Find a formula for the exponential function.



FROM y-INTERCEPT WE KNOW $a = 1/2$

$$y = \frac{1}{2}(b)^x$$

$$\frac{1}{54} = \frac{1}{2}(b)^3$$

$$\frac{1}{27} = b^3$$

$$b = \frac{1}{3}$$

5c $$y = \frac{1}{2}\left(\frac{1}{3}\right)^x$$

3) Consider the exponential functions graphed below.

a. Which of the constants are definitely positive?

a, c, p

d, q, b

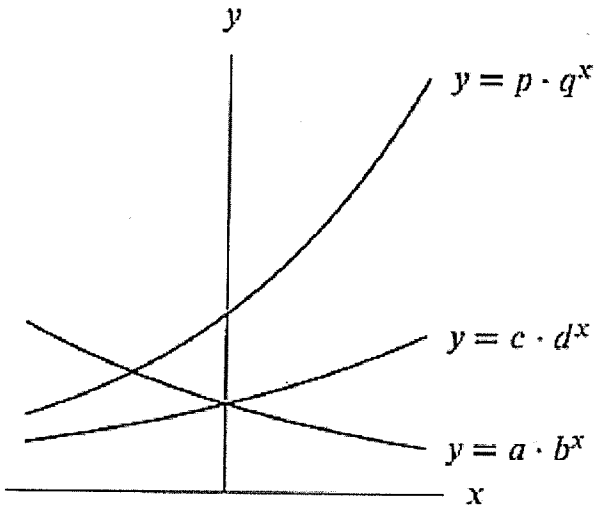
b. Which of the constants are definitely between 0 and 1?

b

c. Which pairs of constants could be equal

C AND a

q AND d



4) If you needed $25,000 six years from now, what is the minimum amount of money you need to deposit into an account the pays 5% annual interest compounded monthly?

$$25{,}000 = P\left(1 + \frac{.05}{12}\right)^{12(6)}$$

$$25000 = P\left(\frac{12.05}{12}\right)^{72}$$

$$P = \frac{25000}{\left(\frac{12.05}{12}\right)^{72}}$$

$$\approx \$18532$$

5) A population is 25,000 in year $t = 0$ and grows at a continuous rate of 7.5% per year.

a. Find a formula for $P(t)$, the population after t years.

$P(t) = 25000\, e^{0.075t}$

b. By what percent does the population increase each year?

$e^{0.075} \approx 1.0779$

So 7.79%

6) Rewrite $\log 19 = 1.279$ using exponents.

$10^{1.279} = 19$

7) Solve $e^{x+5} = 7(2^x)$ for x. EXACT ANSWER

$$e^x e^5 = 7(2^x)$$

$$\left(\frac{e}{2}\right)^x = \frac{7}{e^5}$$

$$\ln\left(\frac{e}{2}\right)^x = \ln\left(\frac{7}{e^5}\right)$$

$$x = \frac{\ln\left(\frac{7}{e^5}\right)}{\ln\left(\frac{e}{2}\right)}$$

8) Find the half-life of Einsteinium-253 which decays at a rate of 3.406%. PSR DAT

$$Q(t) = Q_c (1 - .03406)^t$$

$$\frac{1}{2} Q_c = Q_c (.96594)^t$$

$$\frac{1}{2} = .96594^t$$

$$\ln\left(\frac{1}{2}\right) = \ln(.96594)^t$$

$$\ln\left(\frac{1}{2}\right) = t \ln(.96594)$$

$$t = \frac{\ln(1/2)}{\ln(.96594)}$$

9) Find the hydrogen ion concentration of Hydrochloric acid with a pH of 0.
Hint: $pH = -\log\left[H^+\right]$

$$0 = -\log[H^+]$$

$$0 = \log[H^+]$$

$$10^0 = 10^{\log[H^+]}$$

$$1 = [H^+]$$

1 MOLE/LITER

10) Using the graph below find

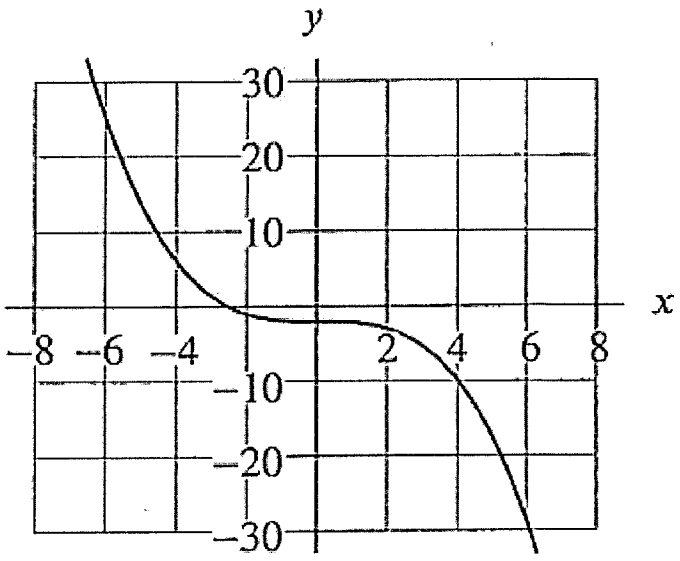
a. $f(-x)$ for $x=-4$ -10

b. $-f(x)$ for $x=-6$ -25

c. $-f(-x)$ for $x=-4$ 10

d. $-f(x+2)$ for $x=0$ 3

e. $f(-x)+4$ for $x=-6$ -26



11) Using the table below, make a table for $-2f(x+1)$

x	-3	-2	-1	0	1	2	3
$f(x)$	2	3	7	-1	-3	4	8
$-2f(x+1)$	-6	-14	2	6	-8	-16	

x	-4	-3	-2	-1	0	1	2
$-2f(x+1)$	-4	-6	-14	2	6	-8	-16

12) The domain and range of $r(x)$ are $-12 \le x \le 12$ and $0 \le r(x) \le 3$. Give the domain and range of $r(2x)$.

DOMAIN: $-12 \le 2x \le 12$

$-6 \le x \le 6$

RANGE: $0 \le r(2x) \le 3$