Name: KEY Class: _____ Date: _____ ID: A

Review units 1-3

True/False
Indicate whether the statement is true or false.

T 1. A polynomial of degree "n" , if n is an even degree, has at most n real zeros.

F 2. If x = a is a zero of a polynomial function, then x + a is a factor. → (x − a) is a factor

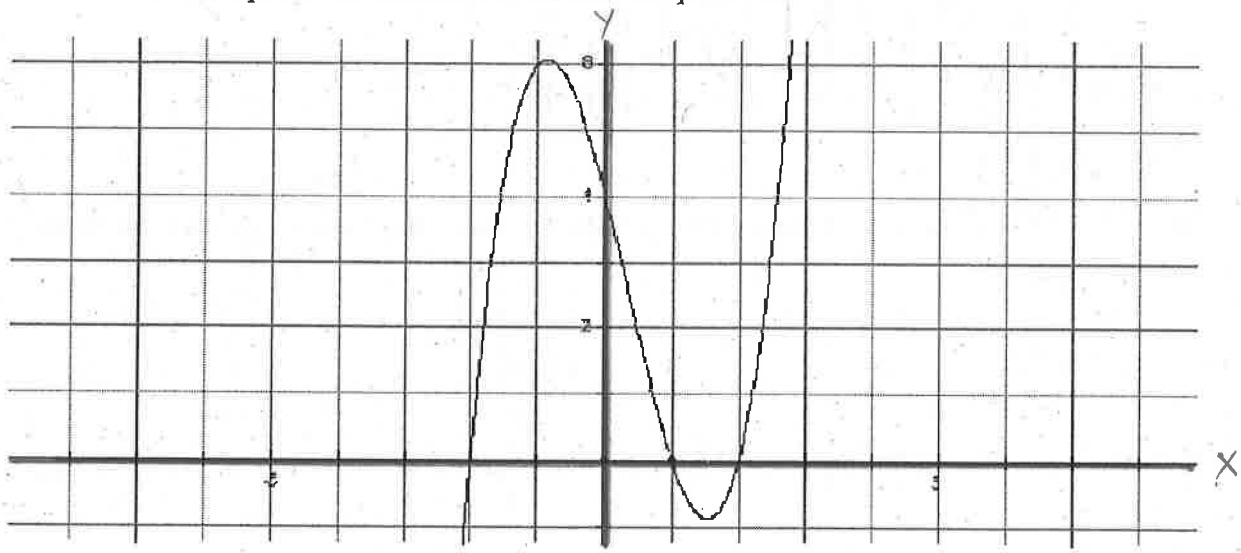
T 3. $y = x^3 + \sqrt{2}x - 1$ is a polynomial function. → $\sqrt{2}$ is a valid coefficient

F 4. A real zero is where the graph crosses or touches the y-axis. → zeros occur on the x-axis

T 5. The vertical line test is used to determine if a relation is a function.

F 6. The domain is the set of y-values. → x-values represent the DOMAIN

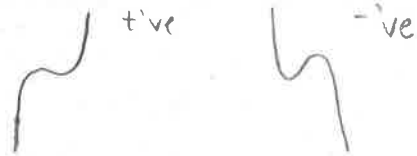
Multiple Choice
Identify the choice that best completes the statement or answers the question.



b 7. Which one of the following functions could describe the graph illustrated?

a. $f(x) = -(x+2)(x-1)(x-2)$
b. $f(x) = (x+2)(x-1)(x-2)$
c. $f(x) = -(x-2)(x+1)(x+2)$
d. $f(x) = (x-2)(x+1)(x+2)$

- This is a positive cubic

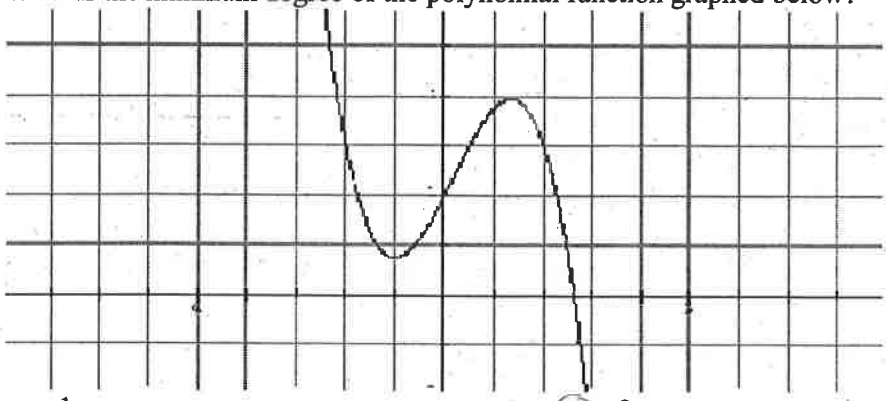


- It has zeros at x = −2, 1, 2

(x+2) (x−1) (x−2)

Name: _____ ID: A

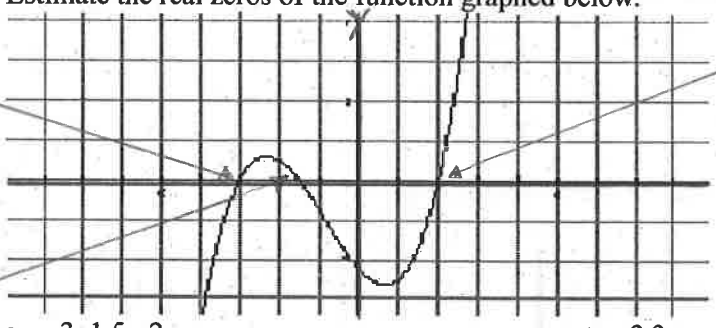
C 8. What is the minimum degree of the polynomial function graphed below?



Three "limbs" to the graph ∴ cubic

a. 1
b. 2
c. 3
d. 4

b 9. Estimate the real zeros of the function graphed below.



a. 3, 1.5, -2
b. -3, -1.5, 2
c. -2.3
d. -2.3, -3, -1.5, 2

d 10. If $3x+1$ is a factor of a polynomial $P(x)$, which one of the following must have a value of 0?

a. $P(1)$
b. $P(-1)$
c. $P\left(\frac{1}{3}\right)$
d. $P\left(-\frac{1}{3}\right)$

$P(-\frac{1}{3}) = 3(-\frac{1}{3}) + 1$
$= -1 + 1 = 0$

OMIT 11. Which one of the following is a possible root of the equation $4x^4 + 2x^3 + kx + 7 = 0$, where k is an integer.

a. 2
b. 4
c. $\frac{7}{2}$
d. $\frac{2}{7}$

d 12. Select a cubic equation with roots -1, 1, and $\frac{2}{3}$.

a. $2x^3 + 3x^2 - 2x - 3 = 0$
b. $2x^3 - 3x^2 - 2x + 3 = 0$
c. $3x^3 + 2x^2 - 3x - 2 = 0$
d. $3x^3 - 2x^2 - 3x + 2 = 0$

$(x+1)(x-1)(x-\frac{2}{3})$
$= (x^2-1)(x-\frac{2}{3})$
$= x^3 - x - \frac{2}{3}x^2 + \frac{2}{3}$
$= x^3 - 3x - 2x^2 + 2$
$= x^3 - 2x^2 - 3x + 2$

misprint 13. Find a polynomial equation that has roots ±4 and 1.

a. $x^3 - x^2 - 16x + 1 = 0$ +16
b. $x^3 + x^2 - 16x - 1 = 0$
c. $x^3 + x^2 - 16x - 1 = 0$
d. $x^3 - x^2 + 16x - 1 = 0$

for(a) $f(4) = 4^3 - 4^2 - 16(4) + 16$
$= 64 - 16 - 64 + 16$
$= 0$

Name: _____ ID: A

$x=0$ $x=2$ $x=\pm 3$

b 14. How many real roots are there for the polynomial equation $x\left(x^2+4\right)(x-2)\left(x^2-9\right)=0$

a. 3
b. 4
c. 5
d. 6

$x^2+4 \neq 0$ for all x

OMIT

15. Solve the inequality $(x+3)^2(x-1)(x-5)<0$

a. $x<-3$
b. $2<x<4$
c. $-3<x<4$
d. $x<-3$ or $x>4$

$(x+3)^2=0$, $x+3=0$, $x=-3$, $x>-3$
$x-1=0$, $x=1$
$x-5=0$, $x=5$, $x<5$

b 16. What is the quotient when $5x^3-6x^2+64$ is divided by $x+2$?

a. $5x^2+4x+8$
b. $5x^2-16x+32$
c. $5x^2+4x+72$
d. $5x^2-16x+96$

-2	5	-6	0	64
		-10	32	-64
	5	-16	32	0

remainder

b 17. What is the remainder when $x^{19}-1$ is divided by $x+1$?

a. -20
b. -2
c. -1
d. 0

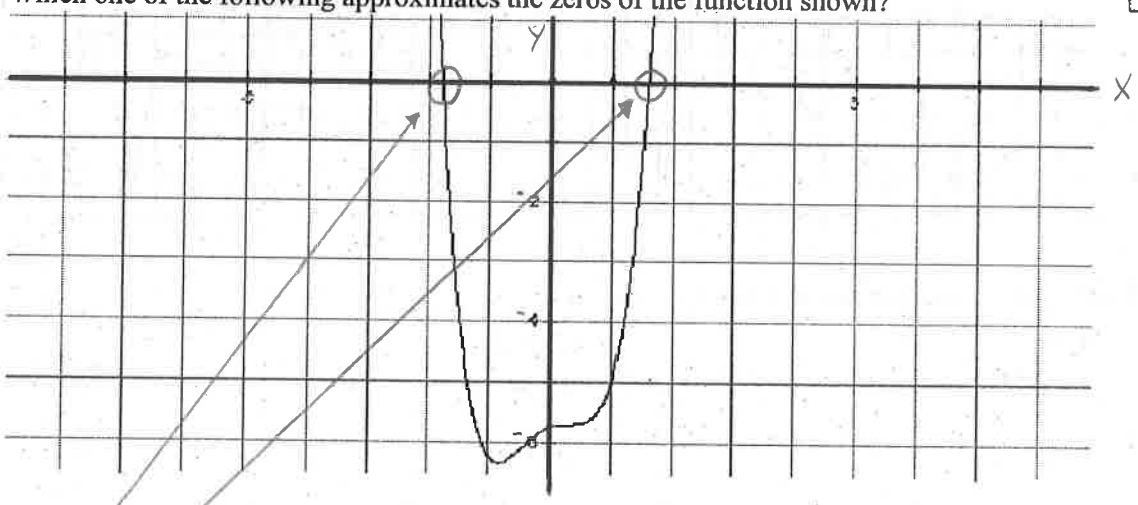
$f(-1)=(-1)^{19}-1$
$=-1-1=-2$

b 18. Determine the quotient when x^3-12x^2+9x-5 is divided by $x-3$.

a. $x^2-9x-16$
b. $x^2-9x-18$
c. $x^2-15x+54$
d. $x^2+9x+36$

3	1	-12	9	-5
		3	-27	-54
	1	-9	-18	-59

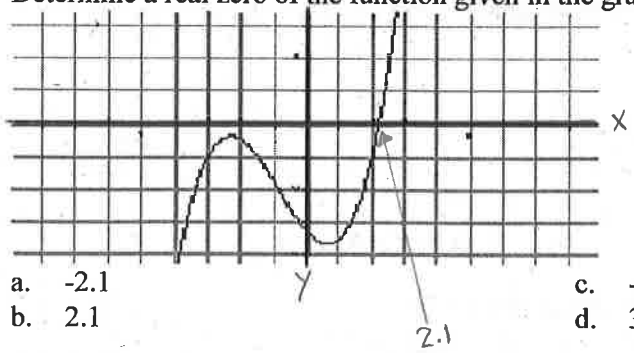
b 19. Which one of the following approximates the zeros of the function shown?



a. -2.2, 1.6
b. -1.8, 1.6
c. -2.2, -2, 1.6
d. -1.8. -2, 1.6

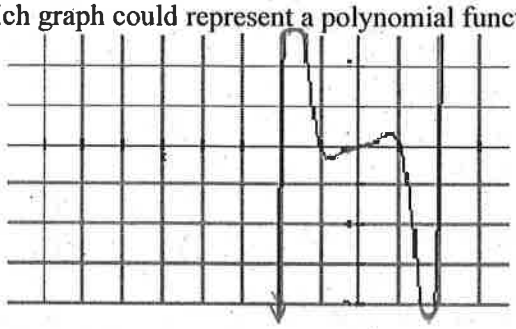
Name: _____ ID: A

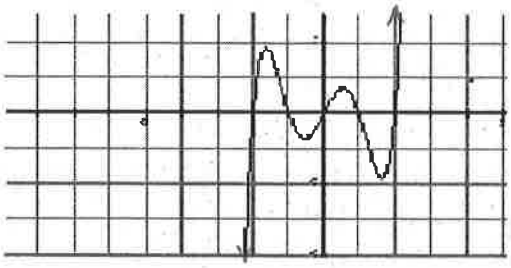
b 20. Determine a real zero of the function given in the graph below.

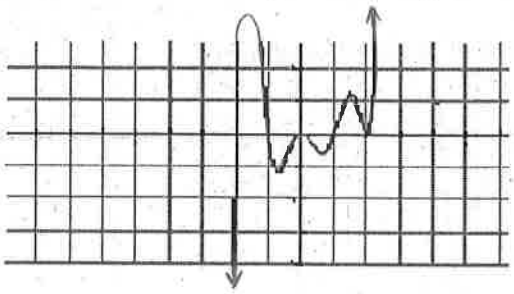


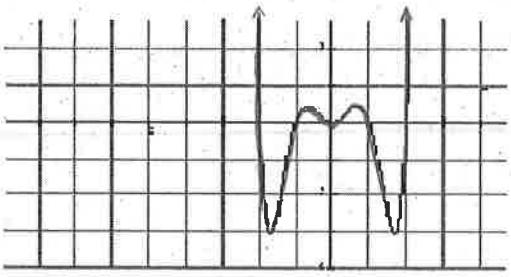
a. -2.1
b. 2.1
c. -3.2
d. 3.2

d 21. Which graph could represent a polynomial function of degree 6?

a. 

c. 

b. 

d. 

b 22. Write $\log_5 t = v$ in exponential form.

a. $t = v^5$
b. $t = 5^v$
c. $v = 5^t$
d. $v = t^5$

The definition of a log states:

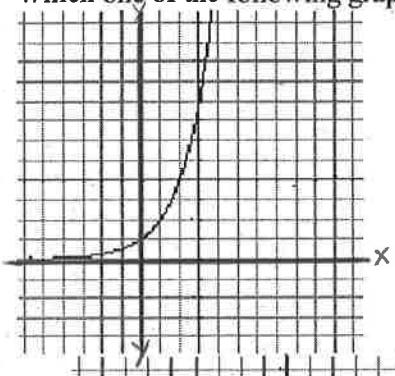
if $a^x = y$

then $\log_a y = x$

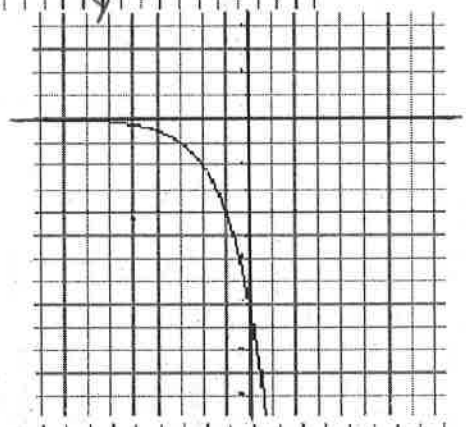
$\therefore$ if $\log_5 t = v$ then $5^v = t$

Name: _____ ID: A

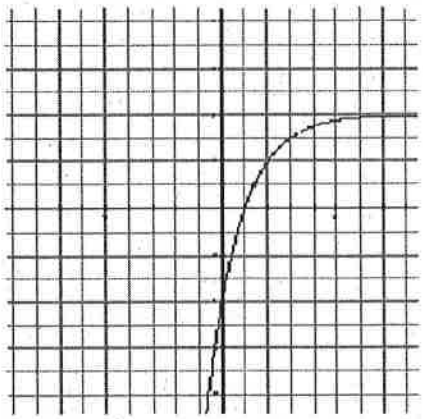
d 23. Which one of the following graphs illustrates the inverse of the function graphed below.



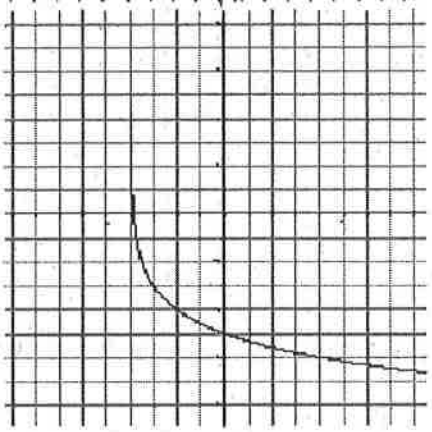
a.



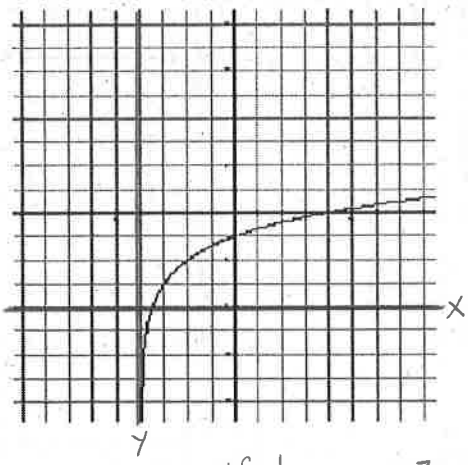
c.



b.



d.



b 24. Solve for x: $\log x = -3$

a. 1000

b. $\frac{1}{1000}$

c. -1000

d. $-\frac{1}{1000}$

if $\log x = -3$
then $10^{-3} = x$

b 25. What is the equation of the asymptote of the graph of the function $y = \log_3(x-2)$?

a. x = 0

b. x = 2

c. x = -2

d. x = 3

$x - 2 > 0$
$x > 2$

Name: _____ ID: A

C 26. Evaluate $\log_5 \sqrt{5}$

a. -2
b. -1
c. $\frac{1}{2}$
d. 1

$= \log_5 5^{\frac{1}{2}} = \frac{1}{2}\log_5 5$
$= \frac{1}{2}(1)$
$= \frac{1}{2}$

b 27. What is the domain of the function $f(x) = \log_3 x$?

a. all real numbers
b. $x > 0$
c. $x < 0$
d. $x > 3$

$x > 0$

d 28. Determine the value of $\log_7 17$.

a. 2.08
b. 0.39
c. 0.69
d. 1.45

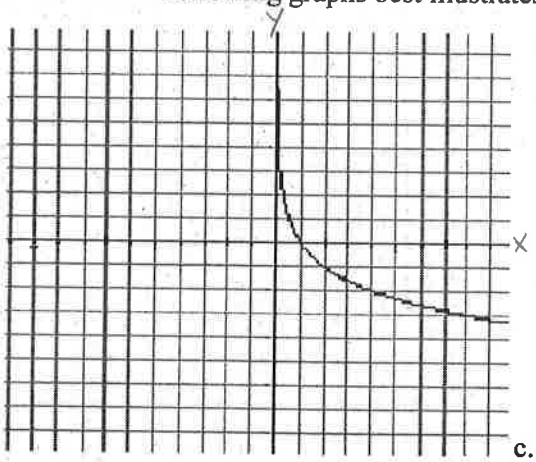
let $\log_7 17 = x$
$\therefore \frac{\log 17}{\log 7} = x$ $x = 1.45$

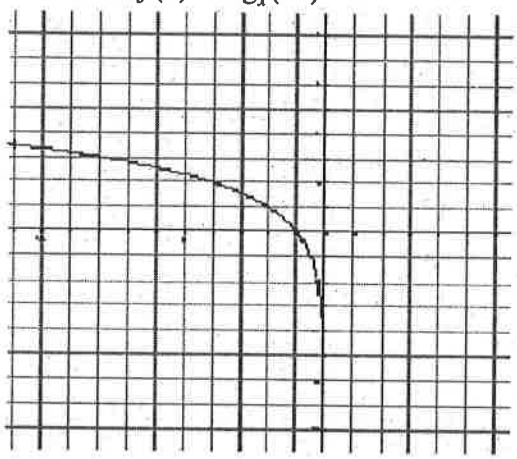
C 29. Solve for x: $\log_7 x = 3$

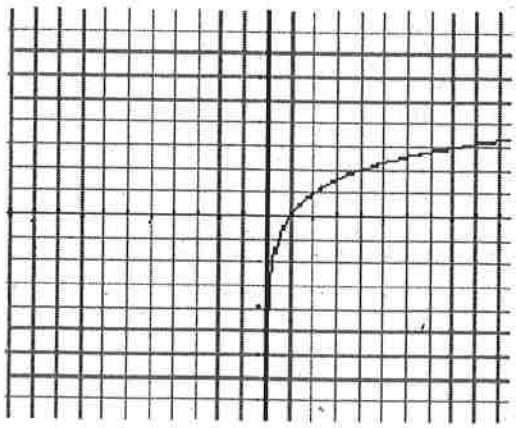
a. $\frac{3}{7}$
b. 21
c. 343
d. 2187

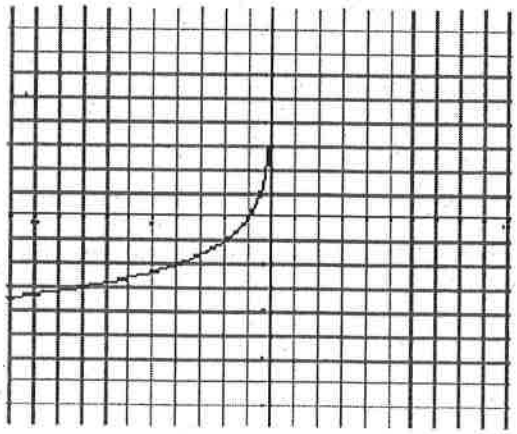
if $\log_7 x = 3$
then $7^3 = x$ $x = 343$

C 30. Which one of the following graphs best illustrates the function $f(x) = \log_x(-x)$

a.


c.


b.


d.


x has been replaced with $-x$ $\therefore$ reflection in y-axis

Name: _____ ID: A

b 31. Determine the inverse of $f(x) = 2^{x-3}$

a. $f^{-1}(x) = 2^{x-3}$
b. $f^{-1}(x) = \log_2 x + 3$
c. $f^{-1}(x) = \log_2(x+3)$
d. $f^{-1}(x) = 2^{3-x}$

rewrite as $y = 2^{x-3}$
"switch" x & y $x = 2^{y-3}$
$\therefore \log_2 x = y - 3$
$\log_2 x + 3 = y$

c 32. Solve for x: $\log 5 = \log x + \log 2$

a. $\frac{2}{5}$
b. 3
c. $\frac{5}{2}$
d. 7

$\log 5 = \log 2x$
$\therefore 5 = 2x \longrightarrow \frac{5}{2} = x$

a 33. Determine an expression for log M, if $M = \frac{xy^3}{\sqrt{z}}$

a. $\log x + 3\log y - \frac{1}{2}\log z$
b. $\frac{\log x + \frac{1}{3}\log y}{2\log z}$
c. $3(\log x + \log y) - \frac{1}{2}\log z$
d. $\frac{\log x + 3\log y}{\frac{1}{2}\log z}$

$\log\left(\frac{xy^3}{\sqrt{z}}\right)$
$= \log xy^3 - \log\sqrt{z}$
$= \log x + \log y^3 - \log z^{\frac{1}{2}}$
$= \log x + 3\log y - \frac{1}{2}\log z$

d 34. Which of the following is equivalent to $\log 4x^2$?

a. $2(\log 4 + \log x)$
b. $\log 16 - 2\log x$
c. $2\log 4 + \log x$
d. $\log 4 + 2\log x$

$\log 4x^2 = \log 4 + \log x^2$
$= \log 4 + 2\log x$

a 35. Solve for y: $x = \log a^y$

a. $\frac{x}{\log a}$
b. $\log a^x$
c. $\frac{x}{a}$
d. $x - \log a$

$x = \log a^y$
$x = y\log a \longrightarrow \frac{x}{\log a} = y$

a 36. Which of the following equations can be used to determine the number of years, t, that are needed for a \$300 deposit to increase to \$1500 if it is invested at 9% compounded annually?

a. $1500 = 300(1.09)^t$
b. $300 = 1500(1.09)^t$
c. $1500 = 300(1.9)^t$
d. $300 = 1500(1.9)^t$

9% compounded annually is 109% = 1.09

d 37. Solve for x: $6^{x-1} = 12$

a. 1.721
b. 1.857
c. 2.079
d. 2.387

$6^{x-1} = 12$
$\log 6^{x-1} = \log 12$
$(x-1)\log 6 = \log 12$
$x - 1 = \frac{\log 12}{\log 6}$
$x = \frac{\log 12}{\log 6} + 1$

c 38. Solve for x: $\log_2(3-x) + \log_2 x = 1$

a. 1
b. 2
c. 1, 2
d. no solution

$\log_2(3-x) + \log_2 x = 1$
$\log_2(3-x)(x) = 1$
$\therefore 2^1 = (3-x)(x)$
$2 = 3x - x^2$
$x^2 - 3x + 2 = 0$
$(x-2)(x-1) = 0$

d 39. Solve for n: $\log_3 n + \log_3 n - \log_3 2 = 4$

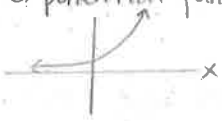
a. 2
b. $2\sqrt{2}$
c. $4\sqrt{2}$
d. $9\sqrt{2}$

$\log_3\left(\frac{n \cdot n}{2}\right) = 4$
$\log_3\left(\frac{n^2}{2}\right) = 4$
$\frac{n^2}{2} = 3^4$
$n^2 = 2 \times 3^4$
$n = \sqrt{2 \times 3^4}$
$n = 3^2\sqrt{2}$

Name: _____ ID: A

vertical translation

base exponential function



b 40. Determine the range of the function $y = 3^x + 2$

a. y > -2
b. y > 2
c. y > 0
d. all real numbers

a 41. Which one of the following equations gives the amount P that should be invested at 7.5% per annum compounded annually, so that $2500 wil be available after 9 years?

$2500 = P(1.075)^9$

a. $P = \frac{2500}{(1.075)^9}$
b. $P = 2500(1.075)^9$
c. $P = \frac{2500}{(0.075)^9}$
d. $P = 2500(0.075)^9$

b 42. A particular bacteria population on Adam's other favourite toy doubles every 6 days. Determine an expression for the number of bacteria B after t days, given an initial amount of 50 bacteria. (Again, thank goodness for soap and water.)

exponent is $t/6$

base is 2

a. $B = 50(6)^{1/2}$
b. $B = 50(2)^{1/6}$
c. $B = 50(6)^{2t}$
d. $B = 50(2)^{6t}$

a 43. Determine the range of the function $y = 7^{x+2} - 4$.

a. y > -4
b. y > -2
c. y > 2
d. y > 4

similar to #40

b 44. The point (-3, 2) is on the graph of the function $f(x) = 2^{x-4}$. Which point must be on the graph of $f^{-1}(x)$?

a. $(-2,3)$
b. $(2,-3)$
c. $(3,-2)$
d. $\left(-\frac{1}{3},\frac{1}{2}\right)$

switch x and y because $f^{-1}(x)$ represents the inverse of $f(x)$.

b 45. If $9^{2x-7} = \frac{1}{729}$, then the value of $\sqrt{x}$ is

$9^{2x-7} = 729^{-1}$
$9^{2x-7} = (9^3)^{-1}$
$9^{2x-7} = 9^{-3}$
$2x-7 = -3$
$2x = 4$
$x = 2$
$\therefore \sqrt{x} = \sqrt{2}$

a. 2
b. $\sqrt{2}$
c. $\sqrt{5}$
d. $\frac{3}{2}$

d 46. The function $y = f(x)$ is transformed to $y = f(3x-6)$. Identify the horizontal expansion or compression factor, then the translation to the graph of the function.

$y = f(3(x-2))$

a. horizontal expansion by a factor of 3, then a translation of 6 units right.
b. horizontal compression by a factor of $\frac{1}{3}$, then a translation of 6 units right.
c. horizontal expansion by a factor of 3, then a translation of 2 units right.
d. horizontal compression by a factor of $\frac{1}{3}$, then a translation of 2 units right.

c 47. If $(6,-5)$ is a point on the graph of $y = f(x)$, what must be a point on the graph of $y = -f(2(x+2)) - 3$?

reflection in x → (6,5)
horiz. comp ($\frac{1}{2}$) → (3,5)
horiz. trans $\xrightarrow{\text{2 units left}}$ (1,5)
vert. trans $\xrightarrow{\text{3 units down}}$ (1,2)

a. $(-1,2)$
b. $(1,-2)$
c. $(1,2)$
d. $(10,2)$

Name: _____ ID: A

b 48. If $(4,-3)$ is a point on the graph of $y=f(x)$, what mus be a point on the graph of $y=f(2x+10)$?

a. $(-8,-3)$
b. $(-3,-3)$
c. $(3,-3)$
d. $(18,-3)$

$y=f(2(x+5))$

$(4,-3) \xrightarrow[\frac{1}{2}]{\text{horiz comp}} (2,-3) \xrightarrow[-5]{\text{horiz trans}} (-3,-3)$

c 49. If (a,b) is a point on the graph of $y=f(x)$, determine a point on the graph of $y=f(x+5)-1$.

a. $(a+5,b-1)$
b. $(a+5,b+1)$
c. $(a-5,b-1)$
d. $(a-5,b+1)$

$a-5$, $b-1$

b 50. Given $f(x)=\frac{1}{3}x-7$, determine $y=f^{-1}(x)$, the inverse of $f(x)$.

a. $f^{-1}(x)=3x+7$
b. $f^{-1}(x)=3x+21$
c. $f^{-1}(x)=3x-7$
d. $f^{-1}(x)=3x-21$

$y=\frac{1}{3}x-7$

$x=\frac{1}{3}y-7$

$x+7=\frac{1}{3}y \longrightarrow 3(x+7)=y$

$3x+21=y$

a 51. Which equation represents the graph of $y=f(x)$ after it is compressed horizontally by a factor of $\frac{1}{3}$ and then translated 2 units left?

a. $y=f(3x+6)$
b. $y=f(3x+2)$
c. $y=f\left(\frac{x+2}{3}\right)$
d. $y=f\left(\frac{x}{3}+2\right)$

$y=f(3x)$

$y=f(3(x+2))$

$y=f(3x+6)$

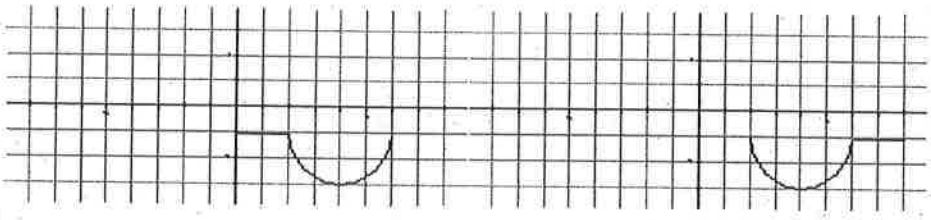
c 52. If $(4,-5)$ is a point on the graph of $y=f(x)$, what must be a point on the graph of $y=-f(2x)+3$?

a. $(-8,-2)$
b. $(-2,-2)$
c. $(2,8)$
d. $(8,8)$

reflection in x $(4,5)$

horiz. comp $(2,5)$

vert. trans. $(2,8)$



b 53. The graph of $y=f(x)$ is shown above on the left. Which equation represents the graph shown on the right?

a. $y=f(-(x+8))$
b. $y=f(-(x-8))$
c. $y=-f(x-8)$
d. $y=-f(x+8)$

• there appears to be a reflection in y and a trans.

$y=f(-x)$

$y=f(-(x-8))$

c 54. The point $(6,-12)$ is on the graph of the function $y=f(x)$. Which point must be on the graph of the function $4y=f(-x)$?

a. $(-6,-48)$
b. $(6,3)$
c. $(-6,-3)$
d. $(6,48)$

vert. comp. factor $\frac{1}{4}$

$(6,-3)$

reflection in y-axis

$(-6,-3)$

Name: _____ ID: A

d 55. The point $(9,-12)$ is on the graph of a function. What will the coordinates of this point be after all of the following transformations are performed on the function, **in the order given**?
- horizontal expansion by a factor of 3 → (27, -12)
- reflection in the x-axis → (27, 12)
- vertical translation of 5 downward → (27, 7)
- refelction in the line y = x → (7, 27)

a. $(-27,7)$
b. $(-17,-27)$
c. $(7,3)$
d. $(7,27)$

C 56. How is the graph $2y = x^3$ related to the graph $y = x^3$? (y replaced with 2y)
a. $y = x^3$ has been vertically translated 2 units up.
b. $y = x^3$ has been expanded vertically by a factor of 2.
c. $y = x^3$ has been compressed vertically by a factor of $\frac{1}{2}$.
d. $y = x^3$ has been compressed horizontally by a factor of $\frac{1}{2}$.

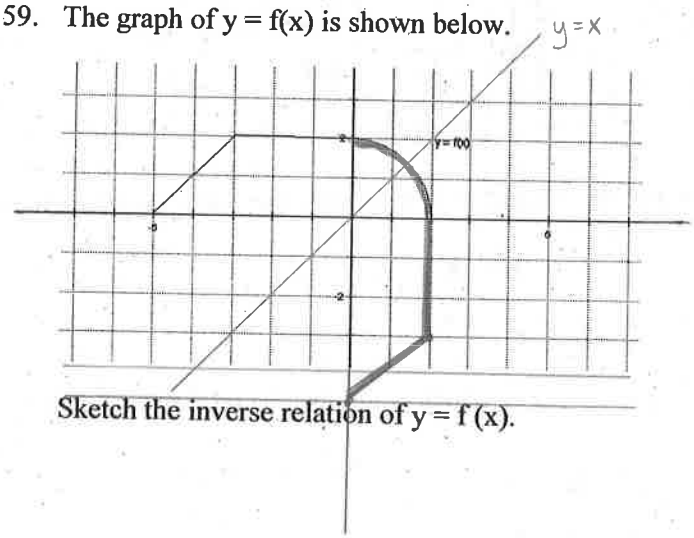
a 57. The graph of $y = f(-x)$ is a reflection of the graph of $y = f(x)$ in
a. the y-axis
b. the x-axis
c. the line y = x
d. the line y = -x

a 58. Which equation represents the graph of $y = \sqrt[3]{x}$ after it is translated 5 units to the left?
a. $y = \sqrt[3]{x+5}$
b. $y = \sqrt[3]{x}+5$
c. $y = \sqrt[3]{x-5}$
d. $y = \sqrt[3]{x}-5$

replace x with x+5

Problem

59. The graph of y = f(x) is shown below.



Sketch the inverse relation of y = f (x).