Pre-Calculus
REVIEW – Unit B

Name Key

Part One: Calculator

For questions 1 – 3, find the domain and range of each function given.

1. $f(x) = \frac{1}{4}x^{-3}$ or $\frac{1}{4}\left(\frac{1}{x}\right)^3$

D: $(-\infty, 0) \cup (0, \infty)$

R: $(-\infty, 0) \cup (0, \infty)$

2. $f(x) = \left(\frac{1}{3}\right)^{x-3} + 3$

Decay

D: $(-\infty, \infty)$

R: $(3, \infty)$

3. $f(x) = \ln(x + 5) - 4$

D: $(-5, \infty)$

R: $(-\infty, \infty)$

4. In 2008, the deer population in a certain area was 800. The number of deer increases exponentially at a rate of 7% per year. During what year will the population triple?

$2400 = 800(1+.07)^t$

$3 = 1.07^t$

$\frac{\ln 3}{\ln 1.07} = \frac{t \ln 1.07}{\ln 1.07}$

$t = 16.24$

2025

5. Find the balance in an account at the end of 8 years if \$6000 is invested at an interest rate of 4.2% that is compounded continuously.

$y = 6000e^{.042(8)}$ \$8,396.03

6. Write $2^{-3} = \frac{1}{8}$ in logarithmic form.

$-3 = \log_2\left(\frac{1}{8}\right)$

7. Evaluate $\log_9 \frac{1}{81}$.

$\frac{1}{81} = 9^x$

$x = -2$

8. Condense $\ln 17 - 2\ln x - 3\ln y$

$\ln \frac{17}{x^2} - 3\ln y$

$\ln \frac{\frac{17}{x^2}}{y^3}$ or $\ln \frac{17}{x^2 y^3}$

9. Condense $2\log x - \log 3$.

$\log \frac{x^2}{3}$

10. Expand $3\log_9 \frac{81x^2}{y^5}$

$\log_9 \left(\frac{81x^2}{y^5}\right)^3$

$\log_9 3^{12} x^6 - \log_9 y^{15}$

$12\log_9 3 + 6\log_9 x - 15\log_9 y$

OR

$6 + \log_9 x^6 - 15\log_9 y$

11. Which is the correct expansion of $\log_3 \frac{6x^2}{4y^3}$?

A $\log_3 6 - \log_3 4 - \log_3 x - \log_3 y$
B $\log_3 6 + 2\log_3 x - [\log_3 4 + 3\log_3 y]$
C $\log_3 6 + 2\log_3 x - \log_3 4 + 3\log_3 y$
D $2\log_3 6x - 3\log_3 4y$

$\log_3 6x^2 - \log_3 4y^3$

$\log_3 6 + 2\log_3 x - [\log_3 4 + 3\log_3 y]$

For 12 - 18 , Solve the equation. Round to the nearest hundredth when necessary.

12. $4^{x-2} = 3$

$\ln \quad \ln$

$(x-2)\ln 4 = \ln 3$

$x\ln 4 - 2\ln 4 = \ln 3$

$x\ln 4 = \ln 3 + 2\ln 4$

$\frac{x\ln 4}{\ln 4} = \frac{\ln 3 + 2\ln 4}{\ln 4}$

$x = \frac{\ln(3 \cdot 4^2)}{\ln 4}$

$x = 2.79$ √it!

13. $\log_4 x^2 + \log_4 5 = \log_4 125$

$\log_4 5x^2 = \log_4 125$

$5x^2 = 125$

$x = \pm 5$

√it!

14. $e^{4x} = 98.6$

$\ln e^{4x} = \ln 98.6$ OR $\frac{4x}{4} = \frac{\ln 98.6}{4}$

$\frac{4x}{4} = \frac{\ln 98.6}{4}$

$x = 1.15$ ✓ it!

15. $\ln x + \ln(x+2) = \ln 35$

$\ln x^2 + 2x = \ln 35$

$x^2 + 2x - 35 = 0$

$(x+7)(x-5) = 0$

$x = -7, 5$ extraneous

16. $3\ln(x-7) = 41$

$\frac{3\ln(x-7)}{3} = \frac{41}{3}$ OR $x - 7 = e^{41/3}$

$e^{\ln(x-7)} = e^{41/3}$

$x - 7 = e^{41/3}$

$+7 \quad +7$

$x = 861{,}710.62$ ✓ it!

17. $\log_6(2x) + \log_6(x-2) = 1$

$\log_6(2x^2 - 4x) = 1$

$2x^2 - 4x - 6 = 0$

$2(x^2 - 2x - 3) = 0$

$(x-3)(x+1) = 0$

$x = -1, 3$

extraneous

18. $\ln x + \ln(x-4) = \ln 12$

$e^{\ln(x^2-4x)} = e^{\ln 12}$ 1 term = 1 term inside =

$x^2 - 4x - 12 = 0$

$(x-6)(x+2) = 0$

$x = -2, 6$

19. The table below shows the population for a given bacteria colony.

Time (days)	0	4	8	12	16	L_1
Population (thousands)	87	112	135	173	224	L_2

stat ▷ calc ▷ ExpReg

Let x represent the number of days and let y represent the population in thousands. Find an exponential regression equation for the data. Round to three decimal places.

$y = 86.979(1.060)^x$

Part Two: Non- Calculator

20. Which describes the end behavior of $f(x) = 4x^3 - 5x^2 + 2x + 3$?

odd ↗↙ $a = 4$ so ↙↗

A $\lim_{x\to-\infty} f(x) = \infty$, $\lim_{x\to\infty} f(x) = \infty$

B $\lim_{x\to-\infty} f(x) = -\infty$, $\lim_{x\to\infty} f(x) = \infty$

C $\lim_{x\to-\infty} f(x) = -\infty$, $\lim_{x\to\infty} f(x) = -\infty$

D $\lim_{x\to-\infty} f(x) = \infty$, $\lim_{x\to\infty} f(x) = -\infty$

21. What are the horizontal and vertical asymptotes of $f(x) = \frac{x^2-4}{x^2-9}$?

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

VA: $x = \pm 3$

HA: $y = 1$

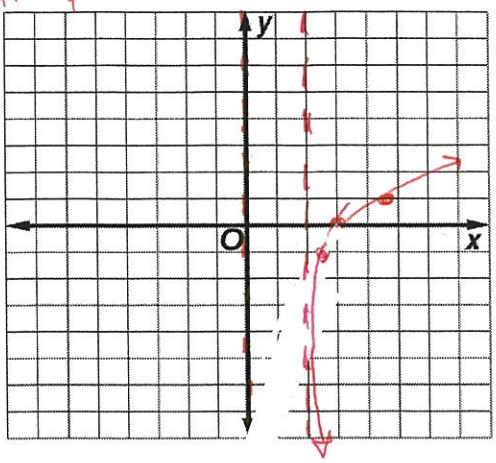
22. Given $f(x) = e^x$ and $g(x) = 2e^{x-2}$, describe the transformations from the parent function.

R 2, VS by 2

For graphs: graph the function (include asymptotes) state the domain, range, asymptote equation, and end behavior.

23. $f(x) = \ln(x-2)$ $y = \log_e(x-2)$ $e^y = x$

Pick y-values



x	y
.4	-1
1	0
2.7	1

RZ (+2)

x	y
2.4	-1
3	0
4.7	1

Domain: $(2, \infty)$

Range: $(-\infty, \infty)$

Any intercepts: x-int at $(3,0)$

Decreasing: none

Decreasing: none

Increasing: $(2, \infty)$

Asymptote Equation: $x = 2$

End Behavior:

$\lim_{x \to \infty} f(x) = \infty$

$\lim_{x \to 2^+} f(x) = -\infty$

24. $f(x) = 3\left(\frac{1}{2}\right)^x$ Decay

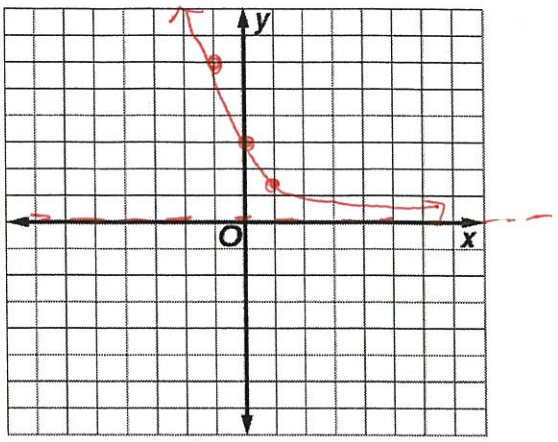
HA is nothing, $= 0$

$y = \frac{1}{2}^x$

x	y
-1	2
0	1
1	.5

VS. $y = 3$

x	y
-1	6
0	3
1	1.5



Domain: $(-\infty, \infty)$

Range: $(0, \infty)$

Any intercepts: y-int at $(0,3)$

Decreasing: $(-\infty, \infty)$

Decreasing: $(-\infty, \infty)$

Increasing: none

Asymptote Equation: $y = 0$

End Behavior:

$\lim_{x \to -\infty} f(x) = \infty$

$\lim_{x \to \infty} f(x) = 0$

25. $f(x) = e^{x-1} + 2$ HA growth

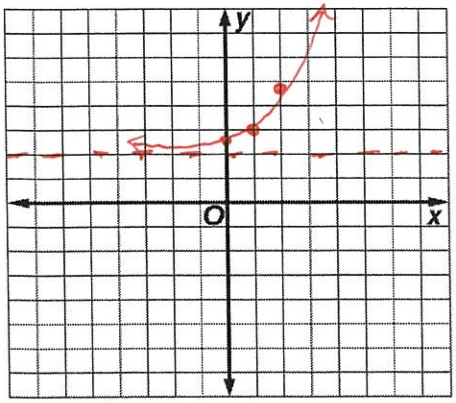
Pick x-values

$y = e^x$

x	y
-1	.4
0	1
1	2.7

$x+1$, $y+2$

x	y
0	2.4
1	3
2	4.7



Domain: $(-\infty, \infty)$

Range: $(2, \infty)$

Any intercepts: y-int at $(0, 2.4)$

Decreasing: none

Decreasing: ~~$(-\infty, \infty)$~~ none

Increasing: $(-\infty, \infty)$

Asymptote Equation: $y = 2$

End Behavior:

$\lim_{x \to \infty} f(x) = \infty$

$\lim_{x \to -\infty} f(x) = 2$

26. $f(x) = -\ln(x+1) + 3$

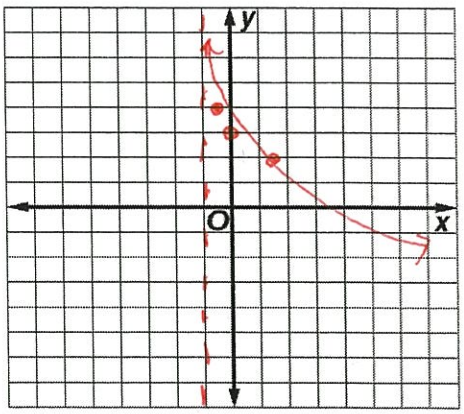
Pick y-values

$= 0$

x	y
.4	-1
1	0
2.7	1

$x-1$, $y \cdot (-1)$ $y+3$

x	y
-.6	4
0	3
1.7	2



Domain: $(-1, \infty)$

Range: $(-\infty, \infty)$

Any intercepts: y-int at $(0,3)$

Decreasing: x-int, but need a calc

Decreasing: $(-1, \infty)$

Increasing: none

Asymptote Equation: $x = -1$

End Behavior:

$\lim_{x \to \infty} f(x) = -\infty$

$\lim_{x \to -1^+} f(x) = \infty$