Name KEY MC: 9 checks FR: 10 checks Total Checks: 19 Date_____ Period_____

TEST: Chapter 4.1 Form A CALCULATOR PERMITTED

I. Multiple Choice: Place the capital letter of the answer choice in the blank to the left of the number.

A 1. The graph of the function $g(x)=27^x$ can be obtained from the graph of $f(x)=3^x$ by

(A) Horizontally compressing f by a factor of 3 (B) Horizontally stretching f by a factor of 3

(C) Vertically compressing f by a factor of 3 (D) Vertically stretching f by a factor of 3

(E) None of these

Start: $f(x)=3^x$ End: $g(x)=27^x$

$g(x)=(3^3)^x$

$=3^{3x}$

So, Horizontally compress $f(x)=3^x$ bfo 3 to obtain $g(x)=27^x$

A 2. Find the range of $f(x)=-3e^{4-5x}-10$

(A) $(-\infty,-10)$ (B) $[-10,\infty)$ (C) $(-\infty,-10]$ (D) $(10,\infty)$ (E) $(-10,\infty)$

A = -3, So, graph lives BELOW the HA

D = -10, So, HA @ $y=-10$

So, the range is $y<-10$

$R_f: \{y \mid y<-10\}$ or $(-\infty,-10)$

A 3. Given a parent function $y=e^x$, which of the following equations represents a horizontal shift of the parent function 3 units right?

(A) $f(x)=3e^{\overbrace{-2(x-3)}^{R+3}\underbrace{-2x+6}}+3$ (B) $f(x)=3e^{\overbrace{2(x+3)}^{\text{Left }3}\underbrace{2x+6}}-3$ (C) $f(x)=3e^{\overbrace{-2(x+3)}^{\text{Left }3}\underbrace{-2x-6}}+3$

(D) $f(x)=3e^{\overbrace{-2(x-\frac{3}{2})}^{R+\frac{3}{2}}\underbrace{-2x+3}}+3$ (E) $f(x)=3e^{\overbrace{-2(x+\frac{3}{2})}^{\text{Left }\frac{3}{2}}\underbrace{-2x-3}}+3$

D 4. If $f(x)=2+\frac{2}{3}e^{\left(\frac{2}{3}x-\frac{5}{3}\right)}$, then compared to the parent function $y=e^x$, the graph of f is

(A) Vertically stretched by a factor of $\frac{3}{2}$ (B) Vertically stretched by a factor of $\frac{2}{3}$

(C) Horizontally compressed by a factor of $\frac{3}{2}$ (D) Horizontally stretched by a factor of $\frac{3}{2}$

(E) Horizontally stretched by a factor of $\frac{2}{3}$

Horz stretch bfo $\frac{3}{2}$ → $\frac{2}{3}\left(x-\frac{15}{6}\right)$

$f(x)=\frac{2}{3}e$ ↑ Vert comp bfo $\frac{3}{2}$

$-\frac{5}{3}\div\frac{2}{3}$

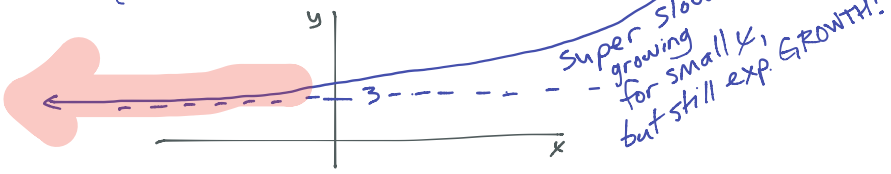
$-\frac{5}{3}\cdot\frac{3}{2}$

$\frac{-15}{6}$

C 5. If $f(x)=3+\frac{1}{5}(1.001)^{\frac{x}{5}}$, what is $\lim_{x\to-\infty} f(x)$?

(A) 0 (B) $\frac{1}{5}$ (C) 3 (D) ∞ (E) $-\infty$

graph: $f(x)=\frac{1}{5}(1.001)^{x/5}+3$



E 6. An exponential function of the form $y=A\cdot b^x$ passes through the points (0, 2) and (3, 10). What is the y-value when $x = 6$?

(A) 70 (B) 60 (C)30 (D) 40 (E) 50

(0,2) is y-int, so $A=2$

$y=2\cdot b^x$

@(3,10): $10=2\cdot b^3$

$5=b^3$

$(5)^{1/3}=(b^3)^{1/3}$

$b=(5)^{1/3}$

So, $y=2\cdot(5^{1/3})^x$

$y=2\cdot 5^{\frac{1}{3}x}$

at $x=6$: $y=2\cdot 5^{(\frac{1}{3}\cdot 6)}$

$=2\cdot 5^2$

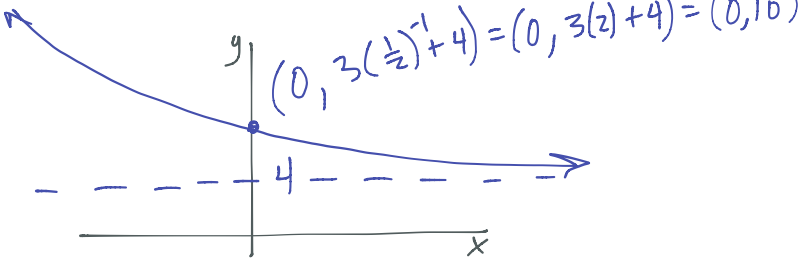
$=2\cdot 25=50$

B 7. Which of the following is not true of the function $f(x)=3\left(\frac{1}{2}\right)^{x-1}+4$

(A) Horizontal asymptote @ $y=4$ ✓ (B) y-intercept @ $(0, 3)$ ✗ at $(0,10)$

(C) It is a decreasing function ✓ (D) $R:(4,\infty)$ ✓ (E) $D:\mathbb{R}$ ✓

graph:



A 8. When $2x^{13}-3x^4+5$ is divided by $x+1$, the remainder is what?

(A) 0 (B) 4 (C) 6 (D) 10 (E) 11

Let $f(x)=2x^{13}-3x^4+5$

since $x+1$ is the divisor
$x=-1$ is the root of the divisor.

the remainder, then, when divided by $x+1$ is $f(-1)=2(-1)^{13}-3(-1)^4+5$

$=2(-1)-3(1)+5$

$=-2-3+5$

$=-5+5$

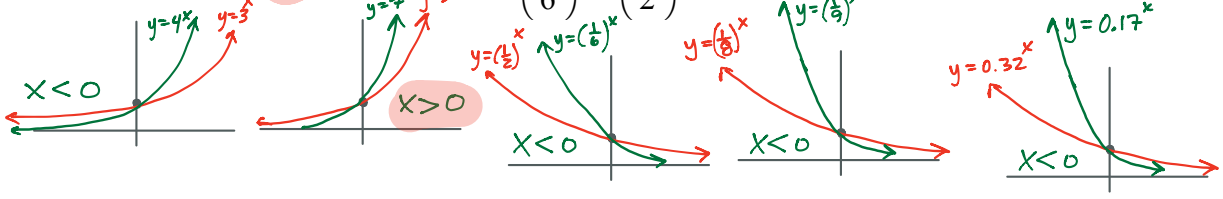
$=0$

* So, $x+1$ is actually a factor of $f(x)$!!!

B 9. For $x>0$, which of the following is true?

right of y-axis

(A) $3^x>4^x$ (B) $7^x>5^x$ (C) $\left(\frac{1}{6}\right)^x>\left(\frac{1}{2}\right)^x$ (D) $9^{-x}>8^{-x}$ $\left(\frac{1}{9}\right)^x>\left(\frac{1}{8}\right)^x$ (E) $0.17^x>0.32^x$



Form A

1 A 4 D 7 B
2 A 5 C 8 A
3 A 6 E 9 B

Form B

1 E 4 A 7 C
2 C 5 C 8 C
3 B 6 E 9 E

Form C

1 D 4 B 7 C
2 B 5 E 8 B
3 A 6 C 9 A

II. Free Response: Show all work in the space provided below the horizontal line. **Use correct units** where appropriate.

10. The number of people at Wassailfest infected with holiday cheer after t minutes is modeled by the function

$$W(t) = \frac{12456}{1+56e^{-0.7t}}$$

Nice Window
$x_{min}=0$
$x_{max}=20$
$y_{min}=0$
$y_{max}=15000$

(a) What was the initial number of Wassailers infected with cheer? (**round** to the nearest person)

$W(0)=218.5263\approx 218$ or 219 (√1) Wassailers or people

units are 1 check ✓ if they are correct on every expressed answer

* answer must be in presence of $W(0)$ or $\frac{12456}{1+56e^{-0.7(0)}}$

(b) After how many minutes will the number of infected Wassailers be 5000? Give an approximation **rounded** to the nearest minute.

$W(t)=5000$ (√2)

$t=5.1796\approx 5$ (√3) minutes units

(c) After how many minutes is the holiday cheer spreading at the fastest rate? (**round** to the nearest minute)

when $W(t)=\frac{12456}{2}$ or $W(t)=6228$ (√4)

$t=5.7505\approx 5$ or 6 (√5) minutes units

(d) How many Wassailers are infected after a 15 minutes? (**round** to the nearest person)

$W(15)=12436.822\approx 12436$ or 12437 (√6) wassailers or people units

* answer must be in presence of $W(15)$ or $\frac{12456}{1+56e^{-0.7(15)}}$

(e) According the model, how many people attended Wassailfest?

$\lim_{t\to\infty} W(t)=12456$ (√7) wassailers or people units

(f) If the Grinch has a plan to crash the Wassailfest festivities if 75% of the Wassailers get infected with the holiday spirit, after how many minutes will he try to implement his sinister plan? (**round** to the nearest minute)

$W(t)=(0.75)(12456)$ or $W(t)=9342$ (√8)

$t=7.31994\approx 7$ (√9) minutes units

units check (√10)