PreCalculus '14-15 Name: SOLUTION KEY
Dr. Quattrin
Exponential Test-- CALCULATOR ALLOWED
Round to 3 decimal places. Score _____
Show all work.

Formulas: $S = \dfrac{P\left(\left(1+\frac{r}{n}\right)^{nt}-1\right)}{\frac{r}{n}}$ $L = \dfrac{P\left(1-\left(1+\frac{r}{n}\right)^{-nt}\right)}{\frac{r}{n}}$

1. Suppose you can take out a 30-year loan for a \$645,000 house, at a fixed APR of 4.25% compounded monthly. What are your monthly payments and how much will you actually pay the bank?

$$645000 = \frac{P\left(1-\left(1+\frac{.0425}{12}\right)^{-360}\right)}{\left(\frac{.0425}{12}\right)}$$

$P = \$3173.01$ TOTAL $= 360\ P = 1,142,284.80$

2. Suppose that, when you graduate from college, you must begin to pay off your \$120,000 student loan. If the loan was at 5% compounded monthly and you can make \$1000 payments per month, how long will it take to pay off the loan?

$$120000 = \frac{1000\left(1-\left(1+\frac{.05}{12}\right)^{-12t}\right)}{.05/12}$$

$$.5 = 1-\left(1+\frac{.05}{12}\right)^{-12t}$$

$$-.5 = -\left(1+\frac{.05}{12}\right)^{-12t}$$

$$.5 = \left(1+\frac{.05}{12}\right)^{-12t}$$

$$\ln .5 = -12t \ln\left(1+\frac{.05}{12}\right)$$

$$-166.70 = -12t$$

$t = 13.892$ YEARS

3a. $\frac{d}{dx}\left[7x^2e^{-3x}\right] = 7x^2 e^{-3x}(-3) + e^{-3x}(14x)$

$= 7x e^{-3x}\left[-3x + 2\right]$

3b. $D_x\left[(4x^5-2)^6(3x^3+7)^5\right]$

$(4x^5-2)^6\ 5(3x^3+7)^4(9x^2) + (3x^3+7)^5\ 6(4x^5-2)^5(20x^4)$

$15x^2(4x^5-2)^5(3x^3+7)^4\left[3(4x^5-2) + 8x^2(3x^3+7)\right]$

$30x^2(4x^5-2)^5(3x^3+7)^4\left[\cancel{36}^{18}x^5 + \cancel{56}^{28}x^2 - \cancel{6}^{3}\right]$

4. Find the zeros and Domain of $y=(3x-x^2)e^x$. Show the supporting algebraic work.

DOMAIN: $x \in$ ALL REALS

ZEROS: (0, 0), (3, 0)

$3x-x^2=0$

$x(3-x)=0$

$x=0, 3$

5. Find the critical values and extreme values of $y=(3x-x^2)e^x$. Show the derivative and algebra to support the critical values.

$\frac{dy}{dx} = (3x-x^2)e^x + e^x(3-2x)$

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

$x = \frac{-1 \pm \sqrt{1+12}}{2(-1)} = \begin{cases} -1.303 \\ 2.303 \end{cases}$

(-1.303, -1.523)

(2.303, 16.059)

6. Find the traits and **sketch** $y=(3x-x^2)e^x$.

Domain: All Reals

Range: $y \leq 16.057$

Y – Int: $(0,0)$

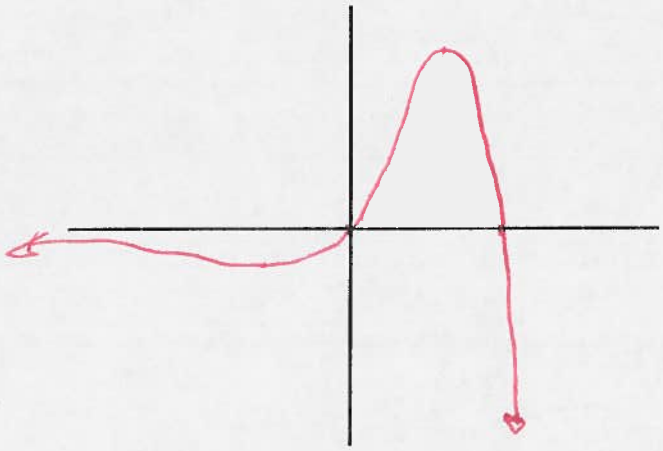
End Behavior: Left= $y=0$

Zeros: $(0,0)$ $(3,0)$

End Behavior: Right= Down

Extreme Points: $(-1.303, -1.523)$

$(2.303, 16.057)$



7. Find the zeros and Domain of $y=-3x\sqrt{36-x^2}$. Show the supporting algebraic work.

Zeros $(0,0)\ (\pm 6,0)$

Domain $36-x^2$: $-$ on $(-\infty,-6)$, $+$ on $(-6,6)$, $-$ on $(6,\infty)$

$x \in [-6,6]$

8. Find the critical values and extreme values of $y=-3x\sqrt{36-x^2}$. Show the derivative and algebra to support the critical values.

$$\frac{dy}{dx} = -3x\left[\frac{1}{2}(36-x^2)^{-1/2}(-2x)\right] + \sqrt{36-x^2}\,(-3)$$

$$= \frac{3x^2}{\sqrt{36-x^2}} - \frac{3\sqrt{36-x^2}\sqrt{36-x^2}}{\sqrt{36-x^2}}$$

$$= \frac{3x^2-(108-3x^2)}{\sqrt{36-x^2}} = \frac{6x^2-108}{\sqrt{36-x^2}} = 0$$

i) $\frac{dy}{dx}=0 \rightarrow 6x^2-108=0 \quad x^2=18 \quad x=\pm 3\sqrt{2}$ $(3\sqrt{2},-54)$ $(-3\sqrt{2},54)$

ii) $\frac{dy}{dx}$ DNE $\Rightarrow x=\pm 6$ $(\pm 6,0)$

9. Find the traits and **sketch** of $y=-3x\sqrt{36-x^2}$.

Domain: $X \in [-6, 6]$

Range: $y \in [-54, 54]$

Y – Int: $(0, 0)$

End Behavior: Left= NONE

Zeros: $(0, 0)$ $(\pm 6, 0)$

End Behavior: Right= NONE

Extreme Points: $(\pm 6, 0)$

$(3\sqrt{2}, -54)$ $(-3\sqrt{2}, 54)$