1. AB Calculus – Step-by-Step **Name ________________________________**

Consider the functions $f(x)=\dfrac{ax^2-b}{x^2-4}$ and $g(x)=\dfrac{x^2-cx+d}{x^2-4}$.

a. If $\lim\limits_{x\to 3} f(x)=6$, find a relationship between *a* and *b*.

b. If, in addition, $\lim\limits_{x\to 1} f(x)=1$, find the values of *a* and *b*.

c. Find $\lim\limits_{x\to -\infty} f(x)$.

d. If $\lim\limits_{x\to 2} g(x)=3$, find *c* and *d*.

2. AB Calculus – Step-by-Step Name ________________________________

The Newton Bridge is a toll bridge that gets a lot of traffic during the two hour rush hour period starting at 4:00 PM. The total number of vehicles that go through the northbound is a differentiable function V of time t. A table of selected values of V is given for the time interval $0 \le t \le 2$ where $t = 0$ corresponds to 4 PM.

t (hours)	0	0.5	1	1.5	2
$V(t)$ (vehicles)	0	200	425	755	unknown

The southbound tollbooth also monitors vehicles that pass through it by estimating the rate of vehicles that come through. This rate is given by the differentiable function R of t. A table of selected values of R is given for the time interval $0 \le t \le 2$ where $t = 0$ corresponds to 4 PM.

t (hours)	0	0.5	1	1.5	2
$R(t)$ (vehicles per hour)	390	425	425	535	460

a. Approximate $V'(0.75)$. Show the computation that leads to your answer. Explain the meaning of your answer in context to the problem situation using correct units of measure.

b. Approximate $R'(1.75)$. Show the computation that leads to your answer. Explain the meaning of your answer in context to the problem situation using correct units of measure.

c. The number of vehicles that have passed through the northbound tollbooth by 6 PM is unknown. It is known that the average rate of change of vehicles passing through this booth between 4 PM and 6 PM is the same as the average rate of change of vehicles passing through this booth between 5 PM and 6 PM. Approximate the total vehicles having passed through the northbound tollbooth by 6:00 PM. Show the computation that leads to your answer.

3. AB Calculus – Step-by-Step **Name ________________________________**

For the following problems, $f(x)=\dfrac{2}{x^2}$ and $g(x)=x^2-6$.

a. Find $\lim\limits_{x\to-\infty} f(x)g(x)$.

b. Find $\dfrac{d}{dx}\left[f(x)g(x)\right]$.

c. Find $\dfrac{d}{dx}\left[x\cdot g(f(x))\right]$.

d. If $\dfrac{1}{y}=f(x)+1$, find $\dfrac{dy}{dx}$.

e. Find $\lim\limits_{\Delta x\to 0}\dfrac{f'(-2+\Delta x)-f'(-2)}{\Delta x}$.

4. AB Calculus – Step-by-Step

Name ________________________________

x	$f(x)$	$f'(x)$	$g(x)$	$g'(x)$
1	4	-3	5	2
2	-3	-1	4	6
3	π	8	-1	4
4	-5	Unknown	0	3

The functions *f* and *g* are differentiable for all real numbers *g*. The table above gives values of the function and their first derivatives at selected values of x.

a. If the function *h* is given by $h(x)=\dfrac{f(x)}{g(x)}+x$, find $h'(1)$.

b. If the function *r* is given by $r(x)=-2f(x)g(x)$, find the equation of the tangent line to $r(x)$ at $x = 2$.

c. If the function *v* is given by $v(x)=\dfrac{f(x)-1}{f(x)}$, find the slope of the line normal to *v* at $x = 3$.

d. If the function *w* is given by $w(x)=xf(x)$ and $w'(4)=9$, find $f'(4)$.

5. AB Calculus – Step-by-Step (Calculators Allowed) **Name ________________________________**

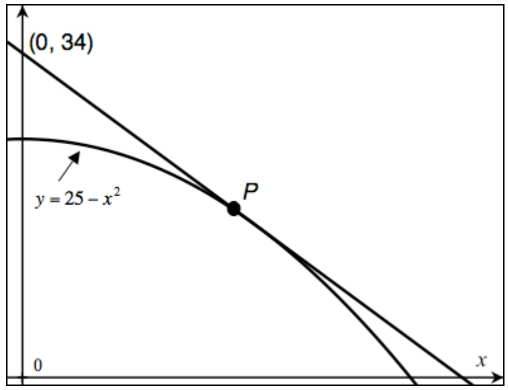
Let $f(x)$ be given by $f(x) = x + \sin x$ which is defined on [0, 2π].

a. Find all exact values of x for which $f'(x) = 1.5$.

b. If $g(x) = \dfrac{f(x)}{x}$, find the equation to the tangent line to g at $x = \dfrac{\pi}{2}$.

c. If $h(x) = \csc x$, find all values of x on [0, 2π] where $f'(x) = h'(x)$.

6. AB Calculus – Step-by-Step **Name** ______________________________



A line is tangent to the graph of $f(x) = 25 - x^2$ at point P, as shown in the figure above.

a. Show that the x-coordinate of point P is 3. Explain your reasoning.

b. Find the equation of the line.

c. Show that the difference between $f(3+a)$ and the linear approximation to $f(x)$ at $x = 3+a$ where a is a constant gives the same value as the difference between $f(3-a)$ and the linear approximation to $f(x)$ at $x = 3-a$.