FRF #1

① AP Calculus
FRQ Planning/Solution Template

Name: Key
Date: ______ Per: ____

(a)

1) Write a complete sentence answer with the actual solution blank.
5) Fill in the blank spot to complete the solution.

$g(-3) = -6 - \frac{9\pi}{4}$

$g'(x) = 2 + f(x)$

$g'(-3) = 2$

2) Write down any given information that will/may be useful. If you end up using something you didn't write down, come back and include it.

$g(x) = 2x + \int_0^x f(t)\,dt$

graph of f ↗

4) Solve the problem. Make use of your strategy and given information. If you find you need more info, go back and revise.

$g(-3) = 2(-3) + \int_0^{-3} f(t)\,dt = -6 - \frac{9\pi}{4}$

area $-\frac{\pi(3)^2}{4}$ neg since going ←

$g'(x) = 2 + f(x)$ ← y-value

$\frac{d}{dx}\int_0^x f(t)\,dt = f(x)$ ← FTC

$g'(-3) = 2 + f(-3) = 2 + 0$

$f(-3)$: (-3, 0) on graph

3) Write down your strategy. Include any definitions, alternate meanings, steps, or things to exclude.

Substitute, $\int$ is an area

derivative of an integral is the inside of integral

(b)

1) Write a complete sentence answer with the actual solution blank.
5) Fill in the blank spot to complete the solution.

The x-coordinate at which g has an abs. max is $x = \underline{5/2}$, because $g'(x) > 0$ on $-4 < x < 5/2$ and $g'(x) < 0$ on $\frac{5}{2} < x < 3$

2) Write down any given information that will/may be useful. If you end up using something you didn't write down, come back and include it.

$g(x) = 2x + \int_0^x f(t)\,dt$

$g'(x) = 2 + f(x)$

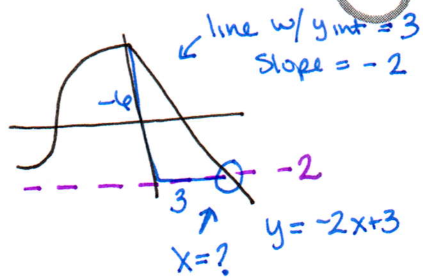
4) Solve the problem. Make use of your strategy and given information. If you find you need more info, go back and revise.

$g'(x) = 2 + f(x)$

$0 = 2 + f(x)$

$f(x) = -2$

from x=0 to 3



$-2x + 3 = -2$

$-2x = -5$

$x = 5/2$

g: inc, dec

g'(x): +, − ; 5/2

3) Write down your strategy. Include any definitions, alternate meanings, steps, or things to exclude.

max occurs when $g' = 0$ and g goes from inc to dec

1 cont FRF #1

AP Calculus
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(c)

1) Write a complete sentence answer with the actual solution blank.
5) Fill in the blank spot to complete the solution.

The x-value(s) for which g has a point of inflection is/are $x =$ 0, because the sign of $g'' = f'$ Changes.

2) Write down any given information that will/may be useful. If you end up using something you didn't write down, come back and include it.

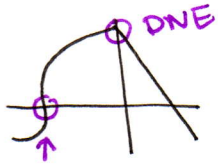
$g'(x) = 2 + f(x)$

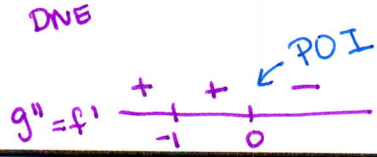
4) Solve the problem. Make use of your strategy and given information. If you find you need more info, go back and revise.

$g'(x) = 2 + f(x)$ ← y-value

$g''(x) = f'(x)$ ← slope

When is slope of f 0 or DNE AND Changes sign





3) Write down your strategy. Include any definitions, alternate meanings, steps, or things to exclude.

find $g'' = 0$ or DNE

Use sign chart to find Changes in sign of g''

(d)

1) Write a complete sentence answer with the actual solution blank.
5) Fill in the blank spot to complete the solution.

The average rate of change of f on $[-4, 3]$ is $-2/7$. The Statement does not contradict the mean Value theorem because f is not differentiable at $x = -3$ and $x = 0$.

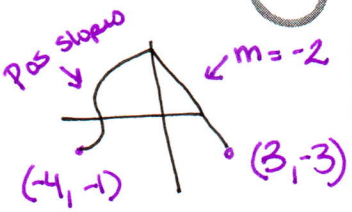
2) Write down any given information that will/may be useful. If you end up using something you didn't write down, come back and include it.

f is the graph
Use y-values

4) Solve the problem. Make use of your strategy and given information. If you find you need more info, go back and revise.

$$\frac{f(3) - f(-4)}{3 - -4} =$$

$$\frac{-3 - -1}{3+4} = \frac{-2}{7}$$



3) Write down your strategy. Include any definitions, alternate meanings, steps, or things to exclude.

Ave rate of change
→ 2 points

$$\frac{f(b) - f(a)}{b - a}$$

MVT
if Cts, diffable
→ Slope through the endpoints = slope of tan line somewhere on f

FRF #1

2

AP Calculus
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(a)

1) Write a complete sentence answer with the actual solution blank.
5) Fill in the blank spot to complete the solution.

The number of people who arrive at the ride between $t=0$ and $t=3$ is 3200 people

2) Write down any given information that will/may be useful. If you end up using something you didn't write down, come back and include it.

graph → rate ppl/hr

4) Solve the problem. Make use of your strategy and given information. If you find you need more info, go back and revise.

$$\int_0^3 r(t)\,dt = \int_0^2 r(t)\,dt + \int_2^3 r(t)\,dt = 3200$$

$$\frac{(1{,}200+1000)}{2}\cdot 2 + \frac{(1{,}200+800)}{2}$$

$$2200 + 1000$$

3) Write down your strategy. Include any definitions, alternate meanings, steps, or things to exclude.

given rate $\frac{\text{ppl}}{\text{hr}}$

integrate to get people

$\int_0^3 \text{ppl/hr} =$ ppl from 0 to 3

integral → area under graph

(b)

1) Write a complete sentence answer with the actual solution blank.
5) Fill in the blank spot to complete the solution.

The number of people waiting in line is increasing / inc/dec between $t=2$ & 3 because people are getting in line to wait at a greater rate than people getting on the ride.

2) Write down any given information that will/may be useful. If you end up using something you didn't write down, come back and include it.

- 800 ppl/hr get on the ride
- graph gives ppl/hr in line

4) Solve the problem. Make use of your strategy and given information. If you find you need more info, go back and revise.

from $t=2$ to $t=3$

$r(2) = 1200$
$r(3) = 800$ thus $r(t) \geq 800$

waiting > loading

3) Write down your strategy. Include any definitions, alternate meanings, steps, or things to exclude.

people waiting − ppl loading

> 0 inc

< 0 dec

waiting > loading
inc

waiting < loading
dec

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2 cont

AP Calculus
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(c)

1) Write a complete sentence answer with the actual solution blank.
5) Fill in the blank spot to complete the solution.

The line for the ride is the longest at $t = \underline{3}$. There are $\underline{1500}$ people in line at that time since $r(t) > 800$ when $t < 3$ and $r(t) < 800$ when $t > 3$.

2) Write down any given information that will/may be useful. If you end up using something you didn't write down, come back and include it.

700 people in line when ride starts

$\int r(t) = \#$ of people

Process 800 people per hr

4) Solve the problem. Make use of your strategy and given information. If you find you need more info, go back and revise.

$r(t) = 800$

$t = 3$ by graph

$r(t) > 800 \quad t < 3$

$r(t) < 800 \quad t > 3$

$700 + 3200 - 800 \cdot 3 = 1500$

700: already in line; 3200: part (a); $800 \cdot 3$: 800 ppl/hr; 1500: people in line

3) Write down your strategy. Include any definitions, alternate meanings, steps, or things to exclude.

line starts to shrink when $r(t) < 800$ since that is when the line will get shorter.

→ People in line = ppl there + ppl waiting − ppl got on ride

(d)

1) Write a complete sentence answer with the actual solution blank.
5) Fill in the blank spot to complete the solution.

The integral equation for when there are 0 People in line is

$$0 = 700 + \int_0^t r(t)\,dt - 800t$$

2) Write down any given information that will/may be useful. If you end up using something you didn't write down, come back and include it.

ppl in line = 700 + ppl waiting − 800 · hrs

4) Solve the problem. Make use of your strategy and given information. If you find you need more info, go back and revise.

$$700 + \int_0^t r(t)\,dt - 800 \cdot t = 0$$

700: already in line; $\int_0^t r(t)\,dt$: People who get in line; $800 \cdot t$: 800 people per hour get on the ride; 0: People in line

3) Write down your strategy. Include any definitions, alternate meanings, steps, or things to exclude.

Use same idea from Part C

no people in line = 0