FRF #3

AP Calculus
FRQ Planning/Solution Template

Name: Key
Date: _____ Per: _____

1

(a)

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

The tan line equation to f @ $x = 1/2$ is

$y = 6(x - \frac{1}{2}) + 1$

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.

$(\frac{1}{2}, 1)$

$f(x) = 8x^3$

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

$f(x) = 8x^3$

$f'(x) = 24x^2$

$f'(\frac{1}{2}) = 24\left(\frac{1}{2}\right)^2 = \frac{24}{4} = 6$

$y = 6(x - \frac{1}{2}) + 1$

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

$y = m(x - x_1) + y_1$

m: $f'(\frac{1}{2})$ x_1: $\frac{1}{2}$ y_1: $f(\frac{1}{2})$

(b)

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

The area of R is $-\frac{1}{8} + \frac{1}{\pi}$

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.

$g(x) = \sin(\pi x)$ ← top

$f(x) = 8x^3$ ← bottom

intersect at $x = 0, \frac{1}{2}$

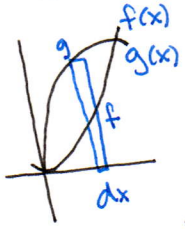
4) Solve the problem. Make use of your strategy and given information. If you find you need more info, go back and revise.

$$\int_0^{1/2} \sin(\pi x) - 8x^3 \, dx$$

$$= \frac{-1}{\pi}\cos(\pi x) - 2x^4 \Big]_0^{1/2}$$

$$= \left(\frac{-1}{\pi}\underbrace{\cos\left(\pi \cdot \tfrac{1}{2}\right)}_{0} - \underbrace{2\left(\tfrac{1}{2}\right)^4}_{\frac{1}{8}}\right) - \left(\frac{-1}{\pi}\underbrace{\cos(\pi \cdot 0)}_{1} - \underbrace{2(0)^4}_{0}\right)$$

$$= -\frac{1}{8} + \frac{1}{\pi}$$

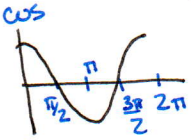


3) Write down your strategy. Include any definitions, alternate meanings, steps, or things to exclude.

∫top − bottom = area

start, stop

dx since rect



FRF #3

1 cent

(C)

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

The integral expression for the volume is

$$\pi \int_0^{1/2} \left[(1-8x^3)^2 + (1-\sin(\pi x))^2 \right] dx$$

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.

start/stop $[0, 1/2]$

$y = 1$ close $g(x)$

far $f(x)$

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

$R = 1 - f(x)$ $\quad r = 1 - g(x)$

$$\pi \int_0^{1/2} (1-f(x))^2 - (1-g(x))^2 \, dx$$

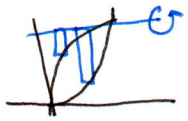
3) Write down your strategy. Include any definitions, alternate meanings, steps, or things to exclude.

Washer → two radii

$\pi \int (\quad)^2 - (\quad)^2 d$

ax - fn

axis $y = 1$



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

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

FRF #3

2

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(a)

1) Write a complete sentence answer with the actual solution blank.
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$$\int_{-2\pi}^{4\pi} f(x)\,dx = 6\pi^2$$

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.

$f(x) = g(x) - \cos\left(\frac{x}{2}\right)$

$g(x)$ - graph

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

$$\int_{-2\pi}^{4\pi} g(x) - \cos\left(\frac{x}{2}\right) dx = \int_{-2\pi}^{4\pi} g(x) - \int_{-2\pi}^{4\pi} \cos\left(\frac{x}{2}\right) dx$$

$\int_{-2\pi}^{4\pi} g(x)\,dx$: $\frac{1}{2}(6\pi)(2\pi)$, base, height

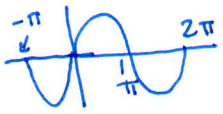
$6\pi^2$

$\int_{-2\pi}^{4\pi} \cos\left(\frac{x}{2}\right) dx$: 0

$$\int_{-2\pi}^{4\pi} \cos\tfrac{x}{2}\,dx = 2\sin\left(\tfrac{x}{2}\right)\Big]_{-2\pi}^{4\pi} = 2\left(\sin\left(\tfrac{4\pi}{2}\right) - \sin\left(\tfrac{-2\pi}{2}\right)\right)$$
$$= 2(\sin 2\pi - \sin(-\pi))$$
$$= 2(0-0)$$

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

rewrite f as pieces
integrate use FTC
for $\cos\left(\frac{x}{2}\right)$
use area for $g(x)$



(b)

1) Write a complete sentence answer with the actual solution blank.
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The x-value(s) for which f has critical points are $x =$ 0, π

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.

$f(x) = g(x) - \cos\left(\frac{x}{2}\right)$

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

$$f'(x) = g'(x) + \tfrac{1}{2}\sin\left(\tfrac{x}{2}\right) = \begin{cases} 1 + \frac{1}{2}\sin\frac{x}{2} & x<0 \\ -\frac{1}{2} + \frac{1}{2}\sin\frac{x}{2} & x>0 \end{cases}$$

$1 + \frac{1}{2}\sin\frac{x}{2} = 0$

$\frac{1}{2}\sin\frac{x}{2} = -1$

$\sin\frac{x}{2} = -2$

never

$-\frac{1}{2} + \frac{1}{2}\sin\frac{x}{2} = 0$

$\frac{1}{2}\sin\frac{x}{2} = \frac{1}{2}$

$\sin\frac{x}{2} = 1$

$\frac{x}{2} = \pi/2$

$\frac{x}{2} = \frac{\pi}{2}$

$x = \pi$

Piecewise derivative must be cts

$1 + \frac{1}{2}\sin\frac{x}{2} = -\frac{1}{2} + \frac{1}{2}\sin\frac{x}{2}$

$1 \neq -\frac{1}{2}$

$x = 0$

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

Critical points
$f' = 0$ or undef
g has two parts
g' = slope

FRF #3

2 cont

(c)

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

$h'(-\pi/3) = 3\pi$

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.

$h(x) = \int_0^{3x} g(t)\,dt$

$g \rightarrow$ graph

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

$h(x) = \int_0^{3x} g(t)\,dt = G(3x) - G(0)$

$h'(x) = \frac{d}{dx}[G(3x)] - \frac{d}{dx}[G(0)]$ ← constant

$= g(3x) \cdot 3$

$h'(-\pi/3) = 3 \cdot g\left(3 \cdot \left(\frac{-\pi}{3}\right)\right) = 3g(-\pi)$ ← y-value $(-\pi, \pi)$

$= 3 \cdot \pi$

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

$\int_a^b g(t)\,dt = G(b) - G(a)$

Use chain rule

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

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