FRF #5

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.

Ben's approximate acceleration is .03 m/s^2 at $t=5$

↑ Units!

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.

$V(10) = 2.3$

$V(0) = 2.0$

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

$$a(5) = V'(5) \approx \frac{V(10)-V(0)}{10-0} = \frac{2.3-2}{10} = \frac{.3}{10}$$

$$= .03 \, m/s^2$$

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

$accel = \frac{\Delta V}{\Delta t}$

approximate → 2 points

Close to $t=5$

(b)

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

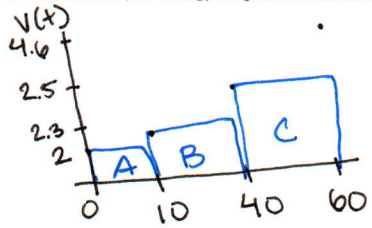
$\int_0^{60} |V(t)|\,dt =$ 139 m ← Units! is the total distance Ben traveled in the 60 second interval.

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.

Use data table

Left values

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



A: $(10-0)2 = 20$ m

B: $(40-10)2.3 = 23.3 = 69$ m

C: $(60-40)2.5 = 25 \cdot 2 = 50$ m

$69 + 50 + 20 = 139$ m

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

$\int |V(t)|$ → total distance from start to stop

Riemann → Rectangles

base · height

Δx y-value on Left side

FRF #5

1 cont

(c)

1) Write a complete sentence answer with the actual solution blank.
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There must / must not be a time when Ben's velocity is 2 m/s from (40, 60) since the mean value theorem applies to the differentiable function B.

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.

B(t) = meters

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

V: on $40 \le t \le 60$ the velocity given are both > 2 m/s ✓

B: on $40 \le t \le 60$ $\quad V'(c) \approx \frac{B(60) - B(40)}{60 - 40} = \frac{49 - 9}{20} = \frac{40}{20}$

$= 2$

Since B is a differentiable function the mean value theorem applies. Thus since there is a time $t = c$ in $[40, 60]$ such that $v(c) = 2$

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

Velocity can be measured using V from table and position $V = \frac{\Delta B}{\Delta t}$

Check BOTH

(d)

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

The rate the distance between Ben and the light is changing is 3/2 m/s.

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.

L(t) = distance between Ben + Light

$L^2 = 12^2 + B^2$

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

$L^2 = 12^2 + B^2 \longrightarrow [L(40)]^2 = 144 + [B(40)]^2$

$2L \cdot \frac{dL}{dt} = 0 + 2B \cdot \frac{dB}{dt}$ ← V(40)

$= 144 + 9^2$

$= 225$

$L(40) = \sqrt{225} = 15$

$(15)\frac{dL}{dt} = (9)(2.5)$ ← 5/2

$\frac{dL}{dt} = \frac{9}{15}\left(\frac{5}{2}\right) = \frac{3}{2}$ m/s

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

all variables wrt t

→ $L' \to \frac{dL}{dt}$ rate dist between ben + light changes

$B' \to \frac{dB}{dt}$ Ben's velocity (table)

at $t = 40$

FRF #5

2 AP Calculus
FRQ Planning/Solution Template

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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 area of R is $4/3$

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.

top → $y = 2x$

bottom → $y = x^2$

$(0,0)$ & $(2,4)$

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

$$A = \int_0^2 2x - x^2 \, dx$$

$$= x^2 - \frac{x^3}{3}\Big]_0^2$$

$$= \left(2^2 - \frac{2^3}{3}\right) - \left(0^2 - \frac{0^3}{3}\right)$$

$$= 4 - \frac{8}{3}$$

$$= \frac{12}{3} - \frac{8}{3} = 4/3$$

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

area = $\int$ top − bottom

Start, Stop

d ?

(b)

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

The volume of the solid is $\frac{4}{\pi}$

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.

$A(x) = \sin\left(\frac{\pi}{2}x\right)$

↑
coming up, out of the page

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

$$V = \int_0^2 A(x)\,dx = \int_0^2 \sin\left(\frac{\pi}{2}x\right) dx$$

$$= \frac{-2}{\pi}\cos\left(\frac{\pi}{2}x\right)\Big]_0^2 = \frac{-2}{\pi}\left(\underbrace{\cos\left(\frac{\pi}{2}\cdot 2\right)}_{\cos\pi\ =\ -1} - \underbrace{\cos\left(\frac{\pi}{2}\cdot 0\right)}_{\cos 0\ =\ 1}\right)$$

$$= \frac{-2}{\pi}(-1-1) = \frac{4}{\pi}$$

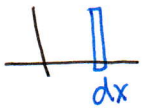
3) Write down your strategy. Include any definitions, alternate meanings, steps, or things to exclude.

$V = \int$ Area

Start / Stop 0, 2

d ?

Perp to x-axis



FRF #5

2 cont

(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 of the solid is $\int_0^4 (\sqrt{y} - \frac{y}{2})^2 dy$

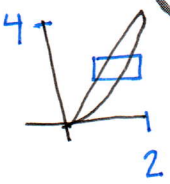
2) Write down any given information that will/may be useful. If you end up using something you didn't write down, come back and include it.

x-sections → squares

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

Side = $(\sqrt{y} - \frac{y}{2})$

R - L



Area = $(\sqrt{y} - \frac{y}{2})^2$

Volume = $\int_0^4 (\sqrt{y} - \frac{y}{2})^2 dy$

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

$A = s^2$

perp to y-axis → dy

$y = 2x \rightarrow x = \frac{y}{2}$

$y = x^2 \rightarrow x = \pm\sqrt{y}$

↑ Since QI

$V = \int A$

start/stop

d?

1) Write a complete sentence answer with the actual solution blank.
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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.