Math 1B (7:30am – 8:20am)
Quiz 6 Version K
Fri May 20, 2011

What month is your birthday ? ___ ___
What are the first 2 digits of your address ? ___ ___
What are the last 2 digits of your zip code ? ___ ___
What are the last 2 digits of your DeAnza ID number ? ___ ___

SCORE: ___ / 30 POINTS

NO CALCULATORS ALLOWED

SHOW PROPER ALGEBRAIC WORK
USE PROPER NOTATION & SIMPLIFY ALL ANSWERS WHERE REASONABLE

MULTIPLE CHOICE: CIRCLE THE CORRECT ANSWER **SCORE: ___ / 3 POINTS**

The average value of $f(x) = \dfrac{5-3x}{\sqrt{x}}$ on $[1, 4]$ is

[a] ➡ $-\frac{7}{6}$ [b] ➡ 3 [c] ➡ $\frac{3}{4}$ [d] ➡ -1 [e] ➡ $-\frac{10}{9}$ [f] ➡ $-\frac{4}{3}$

Find the value of c guaranteed by the Integral Mean Value Theorem for $f(x) = 6x^2 - 5$ on $[-4, 1]$. **SCORE: ___ / 4 POINTS**

$$6c^2-5 = \frac{1}{1-(-4)}\int_{-4}^{1}(6x^2-5)\,dx$$

$$= \frac{1}{5}(2x^3-5x)\Big|_{-4}^{1}$$

$$= \frac{1}{5}(2(1^3-(-4)^3)-5(1-(-4)))$$

$$6c^2-5 = 21 \quad (2)$$

$$6c^2 = 26$$

$$c = \pm\sqrt{\frac{13}{3}}$$

$-\frac{1}{2}$ IF YOUR ANSWER INCLUDED BOTH $\pm\sqrt{\frac{13}{3}}$

$$c = -\sqrt{\frac{13}{3}} \in [-4,1] \quad (1)$$

Find the arc length function for the curve $y = \dfrac{1}{6}(4x^2-2)^{\frac{3}{2}}$ with starting point $\left(1, \dfrac{\sqrt{2}}{3}\right)$. **SCORE: ___ / 6 POINTS**

Simplify your answer COMPLETELY.

$$s(x) = \int_1^x \sqrt{1+\left(\frac{1}{6}\cdot\frac{3}{2}(4t^2-2)^{\frac{1}{2}}\cdot 8t\right)^2}\,dt \quad (1\tfrac{1}{2})$$

$$= \int_1^x \sqrt{1+(2t\sqrt{4t^2-2})^2}\,dt$$

$$= \int_1^x \sqrt{1+4t^2(4t^2-2)}\,dt$$

$$= \int_1^x \sqrt{1-8t^2+16t^4}\,dt \quad (2)$$

$$= \int_1^x (4t^2-1)\,dt \quad (1)$$

$$= \left(\frac{4}{3}t^3-t\right)\Big|_1^x \quad (1\tfrac{1}{2})$$

$$= \frac{4}{3}x^3-x-\frac{1}{3} \quad (1)$$

The curve $x = 4\sqrt{y-4}$ for $y \in [8, 13]$ is revolved around the $y-$ axis. **SCORE: ___ / 10 POINTS**

[a] Find the resulting surface area using a dy integral.

SEE 7:30 VERSION R

[b] Write, **BUT DO NOT EVALUATE**, a dx integral for the same surface area.

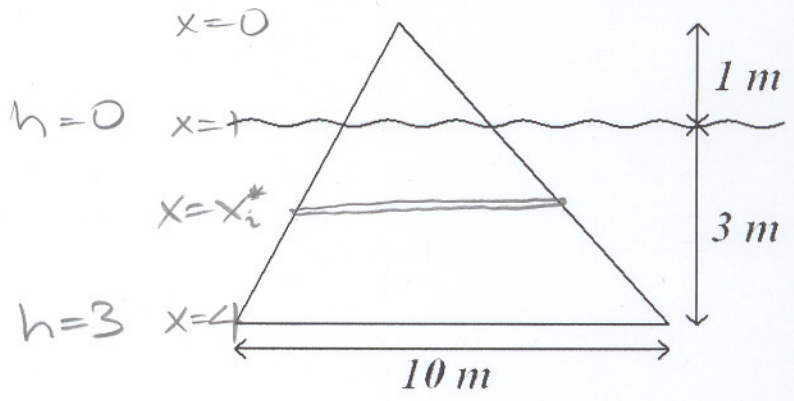
SEE 7:30 VERSION R

A vertical plate is partially submerged in water as shown on the right. Find the hydrostatic force on the plate. **SCORE: ___ / 7 POINTS**

NOTE: You MAY use the symbols ρ, δ and/or g in your final answers, if you write down their values underneath your answer.

$x - h = 1 \longrightarrow h = x - 1$

$\frac{w}{x_i^*} = \frac{10}{4} \rightarrow w = \frac{5}{2}x_i^*$



$\int_1^4 (x-1)\rho g\left(\frac{5}{2}x\right) dx$

$= \frac{5}{2}\rho g \int_1^4 (x^2 - x)\, dx$

$= \frac{5}{2}\rho g \left(\frac{1}{3}x^3 - \frac{1}{2}x^2\right)\Big|_1^4$

$= \frac{5}{2}\rho g \left(\frac{1}{3}(4^3 - 1^3) - \frac{1}{2}(4^2 - 1^2)\right)$

$= \frac{5}{2}\rho g \left(21 - \frac{15}{2}\right)$

$= \frac{5}{2}\rho g \left(\frac{27}{2}\right)$

$= \frac{135}{4}\rho g$ N

$\rho = 1000$, $g = 9.8$

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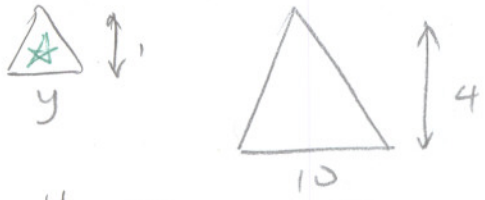
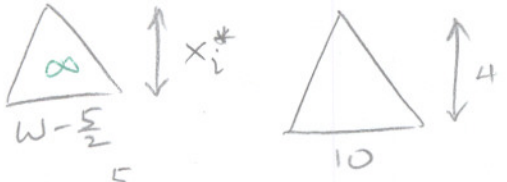
TOP



$\frac{y}{1} = \frac{10}{4} \rightarrow y = \frac{5}{2}$



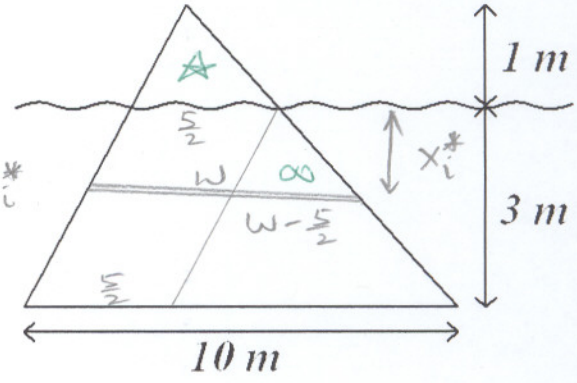
$\frac{w - \frac{5}{2}}{x_i^*} = \frac{10}{4} \rightarrow w = \frac{5}{2}x_i^* + \frac{5}{2}$

OR

$h=0 \quad x=0$

$x = x_i^*$

$h=3 \quad x=3$



$$\int_0^3 x\rho g\left(\tfrac{5}{2}x + \tfrac{5}{2}\right) dx$$

$$= \tfrac{5}{2}\rho g \int_0^3 (x^2 + x)\, dx$$

$$= \tfrac{5}{2}\rho g \left(\tfrac{1}{3}x^3 + \tfrac{1}{2}x^2\right)\Big|_0^3$$

$$= \tfrac{5}{2}\rho g \left(\tfrac{1}{3}(3)^3 + \tfrac{1}{2}(3)^2\right)$$

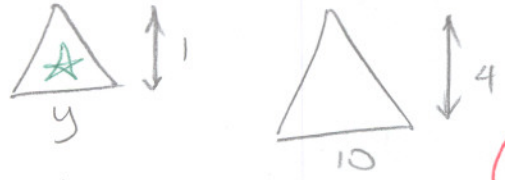
$$= \tfrac{5}{2}\rho g \left(9 + \tfrac{9}{2}\right)$$

$$= \tfrac{5}{2}\rho g \left(\tfrac{27}{2}\right)$$

$$= \boxed{\tfrac{135}{4}\rho g \text{ N}}$$

$\boxed{\rho = 1000,\ g = 9.8}$

TOP



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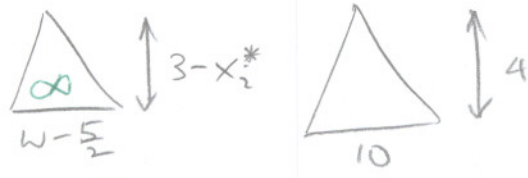


$\frac{w - \frac{5}{2}}{3 - x_i^*} = \frac{10}{4} \rightarrow w = 10 - \frac{5}{2}x_i^*$

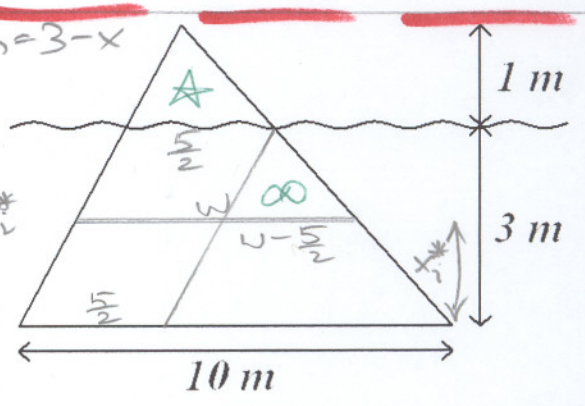
$h + x = 3 \rightarrow h = 3 - x$

$h=0 \quad x=3$

OR

$x = x_i^*$

$h=3 \quad x=0$



$$\int_0^3 (3-x)\rho g\left(10 - \tfrac{5}{2}x\right) dx$$

$$= \rho g \int_0^3 \left(30 - \tfrac{35}{2}x + \tfrac{5}{2}x^2\right) dx$$

$$= \rho g \left(30x - \tfrac{35}{4}x^2 + \tfrac{5}{6}x^3\right) dx$$

$$= \rho g \left(30(3) - \tfrac{35}{4}(3)^2 + \tfrac{5}{6}(3)^3\right)$$

$$= \rho g \left(90 - \tfrac{315}{4} + \tfrac{45}{2}\right)$$

$$= \boxed{\tfrac{135}{4}\rho g \text{ N}}$$

$\boxed{\rho = 1000,\ g = 9.8}$