**Math 1B (7:30am – 8:20am)**
**Quiz 6 Version W**
**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 $f(x)=\dfrac{1-x}{\sqrt{x}}$ on $[1, 4]$ is

[a] ➡ $2\frac{2}{3}$ [b] ➡ $-\frac{2}{3}$ [c] ➡ $\frac{3}{4}$ [d] ➡ $-\frac{8}{9}$ [e] ➡ $-\frac{5}{6}$ [f] ➡ $-\frac{7}{9}$

Find the value of $c$ guaranteed by the Integral Mean Value Theorem for $f(x)=3x^2-11$ on $[-4, 1]$. **SCORE: ___ / 4 POINTS**

$$3c^2-11=\frac{1}{1-(-4)}\int_{-4}^{1}(3x^2-11)\,dx$$

$$=\frac{1}{5}\left(x^3-11x\right)\Big|_{-4}^{1}$$

$$=\frac{1}{5}\left(1^3-(-4)^3-11(1-(-4))\right)$$

$$3c^2-11=2$$

$$3c^2=13$$

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

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

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

Find the arc length function for the curve $y=\frac{1}{3}(4x^2+1)^{\frac{3}{2}}$ with starting point $\left(1,\frac{5\sqrt{5}}{3}\right)$. **SCORE: ___ / 6 POINTS**

**Simplify your answer COMPLETELY.**

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

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

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

$$=\int_1^x\sqrt{1+16t^2+64t^4}\,dt$$

$$=\int_1^x(1+8t^2)\,dt$$

$$=\left(t+\frac{8}{3}t^3\right)\Big|_1^x$$

$$=\frac{8}{3}x^3+x-\frac{11}{3}$$

The curve $x = 2\sqrt{y-1}$ for $y \in [5, 10]$ is revolved around the $y-$axis. **SCORE: ___ / 10 POINTS**

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

$$\int_5^{10} 2\pi \left(2\sqrt{y-1}\right)\sqrt{1+\left(\frac{2}{2\sqrt{y-1}}\right)^2}\,dy$$

$$= \int_5^{10} 4\pi\sqrt{y-1}\sqrt{1+\frac{1}{y-1}}\,dy$$

$$= \int_5^{10} 4\pi\sqrt{y-1+1}\,dy$$

$$= \int_5^{10} 4\pi\sqrt{y}\,dy = 4\pi\left(\frac{2}{3}y^{\frac{3}{2}}\right)\Big|_5^{10} = \frac{8}{3}\pi\left(10^{\frac{3}{2}} - 5^{\frac{3}{2}}\right)$$

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

$x = 2\sqrt{y-1} \longrightarrow y = \frac{x^2}{4} + 1$

$y = 5 \longrightarrow x = 4$

$y = 10 \longrightarrow x = 6$

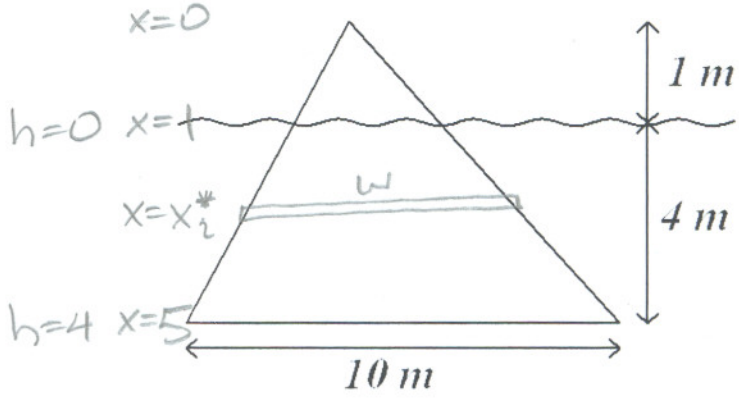
$$\int_4^6 2\pi x\sqrt{1+\left(\frac{2x}{4}\right)^2}\,dx = \int_4^6 2\pi x\sqrt{1+\frac{x^2}{4}}\,dx$$

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 $\rho$, $\delta$ and/or $g$ in your final answers, if you write down their values underneath your answer.**

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


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




$$\int_1^5 (x-1)\rho g(2x)\,dx$$

$$= 2\rho g\int_1^5 (x^2 - x)\,dx$$

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

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

$$= 2\rho g\left(\frac{124}{3} - 12\right)$$

$$= 2\rho g\left(\frac{88}{3}\right)$$

$$= \frac{176}{3}\rho g \text{ N}$$

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

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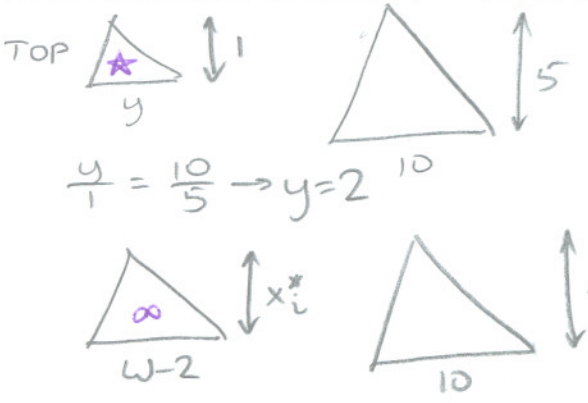
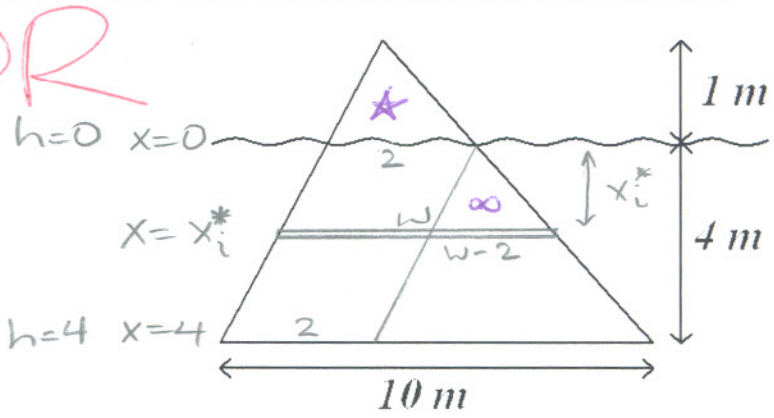



$\frac{y}{1} = \frac{10}{5} \rightarrow y = 2$

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

OR




$$\int_0^4 x\rho g(2x+2)\,dx$$
$$= \rho g \int_0^4 (2x^2+2x)\,dx$$
$$= \rho g \left(\tfrac{2}{3}x^3 + x^2\right)\Big|_0^4$$
$$= \rho g \left(\tfrac{2}{3}4^3 + 4^2\right)$$
$$= \rho g \left(\tfrac{128}{3} + 16\right)$$
$$= \tfrac{176}{3}\rho g \text{ N}$$

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

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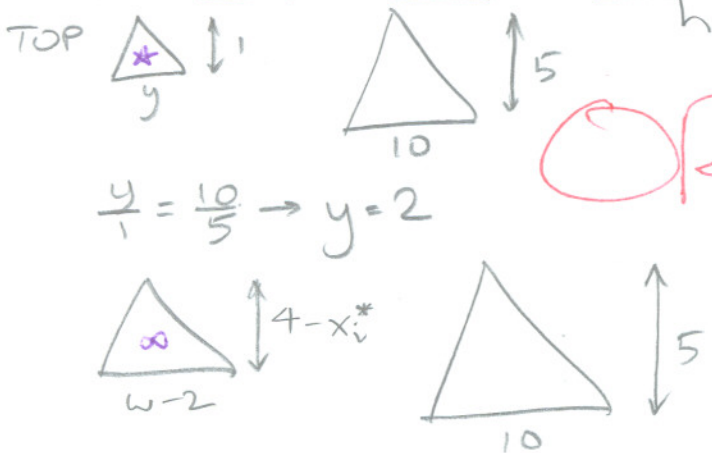
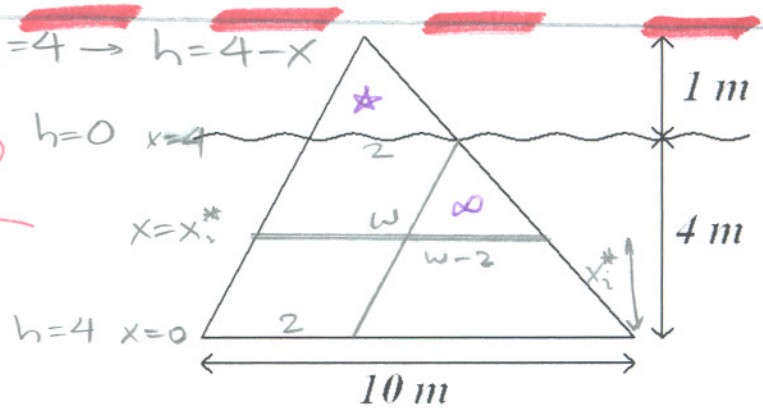



$\frac{y}{1} = \frac{10}{5} \rightarrow y = 2$

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

OR

$h + x = 4 \rightarrow h = 4 - x$




$$\int_0^4 (4-x)\rho g(10-2x)\,dx$$
$$= \rho g \int_0^4 (40 - 18x + 2x^2)\,dx$$
$$= \rho g \left(40x - 9x^2 + \tfrac{2}{3}x^3\right)\Big|_0^4$$
$$= \rho g \left(40(4) - 9(4)^2 + \tfrac{2}{3}(4)^3\right)$$
$$= \rho g \left(160 - 144 + \tfrac{128}{3}\right)$$
$$= \tfrac{176}{3}\rho g \text{ N}$$

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