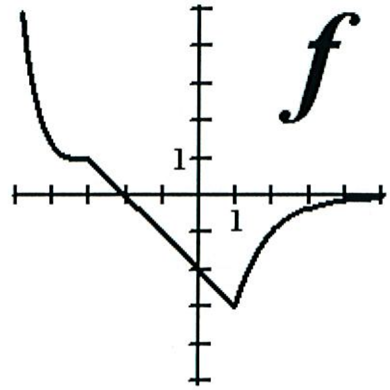
Let $g(x) = \int_0^x f(t)\,dt$, where f is the function whose graph is shown on the right. **SCORE: _____ / 5 PTS**



[a] Find $g'(2)$. **Explain your answer very briefly.**

$\underbrace{g'(2)=f(2)}_{\frac{1}{2}} = \underbrace{-1}_{\frac{1}{2}}$

[b] Find all intervals over which g is increasing. **Explain your answer very briefly.**

$\underbrace{g'(x)=f(x)>0}_{1}$, ON $(-\infty,-2)$ OR $(-5,-2)$] 1 EITHER IS OK

[c] Find all intervals over which g is concave up. **Explain your answer very briefly.**

$\underbrace{g'(x)=f(x) \text{ INCREASING}}_{1}$ ON $(1,\infty)$ OR $(1,5)$] 1 EITHER IS OK

A new office building is renting office space month-by-month for $R(x)$ dollars per square meter if the tenant rents x square meters. What is the meaning of the equation $\int_{2000}^{2200} R(x)\,dx = 3000$ in this situation ? **SCORE: _____ / 3 PTS**

NOTES: **Your answer must use all three numbers from the equation, along with correct units.**
Your answer should NOT use "x", "R(x)", "integral", "antiderivative", "rate of change" or "derivative".

IF YOU ENLARGE YOUR OFFICE FROM 2000 m^2 TO 2200 m^2, YOUR RENT WILL INCREASE BY \$3000

GRADED BY ME

AJ was looking at BJ's homework. **SCORE: _____ / 3 PTS**
AJ said that BJ's work (shown below) was wrong, but BJ insisted that it was correct. Who was right, and why ?

$$\int_0^{\pi} \sec^2\theta\, d\theta \;=\; \tan\theta\Big|_0^{\pi} \;=\; \tan\pi - \tan 0 \;=\; 0-0 \;=\; 0$$

AJ – $\sec^2\theta$ IS NOT CONTINUOUS ON $[0,\pi]$ @ $\theta = \frac{\pi}{2}$

GRADED BY ME

If $p(x) = \int_{e^{4x}}^{\cosh^{-1} x} \cos^8 t \, dt$, find $p'(x)$. **SCORE: _____ / 4 PTS**

$$\frac{d}{dx}\left[\int_{e^{4x}}^{0} \cos^8 t \, dt + \int_0^{\cosh^{-1}x} \cos^8 t \, dt\right]$$

$$= \frac{d}{dx}\left[-\int_0^{e^{4x}} \cos^8 t \, dt + \int_0^{\cosh^{-1}x} \cos^8 t \, dt\right] \quad 1$$

$$= \frac{-d}{d(e^{4x})}\int_0^{e^{4x}} \cos^8 t \, dt \cdot \frac{d(e^{4x})}{dx} + \frac{d}{d(\cosh^{-1}x)}\int_0^{\cosh^{-1}x} \cos^8 t \, dt \cdot \frac{d(\cosh^{-1}x)}{dx}$$

$$1 \quad = -4e^{4x} \; \tfrac{1}{2} \; \cos^8 e^{4x} \; \tfrac{1}{2} + \frac{1}{\sqrt{x^2-1}} \; \tfrac{1}{2} \; \cos^8 \cosh^{-1} x \; \tfrac{1}{2}$$

Evaluate the following integrals. ALL PARTS WORTH $\frac{1}{2}$ POINT EXCEPT THOSE MARKED EXPLICITLY **SCORE: _____ / 10 PTS**

[a] $\int \frac{(3+y)^2}{\sqrt[3]{y}} dy$

$$= \int \frac{9+6y+y^2}{y^{\frac{1}{3}}} dy \quad 1$$

$$= \int (9y^{-\frac{1}{3}} + 6y^{\frac{2}{3}} + y^{\frac{5}{3}}) dy$$

$$= \frac{27}{2} y^{\frac{2}{3}} + \frac{18}{5} y^{\frac{5}{3}} + \frac{3}{8} y^{\frac{8}{3}} + C$$

[b] $\int_{-\frac{1}{2}}^{\frac{1}{2}} \frac{(\pi - \arctan 2t)^2}{1+4t^2} dt$

$u = \pi - \arctan 2t$

$du = -\frac{2}{1+4t^2} dt$

$-\frac{1}{2} du = \frac{1}{1+4t^2} dt$

$t = -\frac{1}{2} \rightarrow u = \pi - \arctan(-1)$

$= \pi - (-\frac{\pi}{4}) = \frac{5\pi}{4}$

$t = \frac{1}{2} \rightarrow u = \pi - \arctan 1$

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

$$\int_{\frac{5\pi}{4}}^{\frac{3\pi}{4}} -\frac{1}{2} u^2 du = -\frac{1}{6} u^3 \Big|_{\frac{5\pi}{4}}^{\frac{3\pi}{4}}$$

1

MUST HAVE "du"

$$= -\frac{1}{6}\left(\left(\frac{3\pi}{4}\right)^3 - \left(\frac{5\pi}{4}\right)^3\right)$$

$$= -\frac{1}{6}\left(\frac{27\pi^3}{64} - \frac{125\pi^3}{64}\right)$$

$$= -\frac{1}{\cancel{6}_3} \cdot -\frac{\cancel{98}^{49}\pi^3}{64}$$

$$= \frac{49\pi^3}{192} \quad 1$$

[c] $\int_{-1}^{1} \frac{7x^3}{(3-2x^6)^5} dx$

$f(x)$ IS CONTINUOUS ON $[-1, 1]$

$$f(-x) = \frac{7(-x)^3}{(3-2(-x)^6)^5} = -\frac{7x^3}{(3-2x^6)^5} = -f(x) \quad 1$$

SO $f(x)$ IS ODD ON $[-1, 1]$

SO $\int_{-1}^{1} f(x) dx = 0$