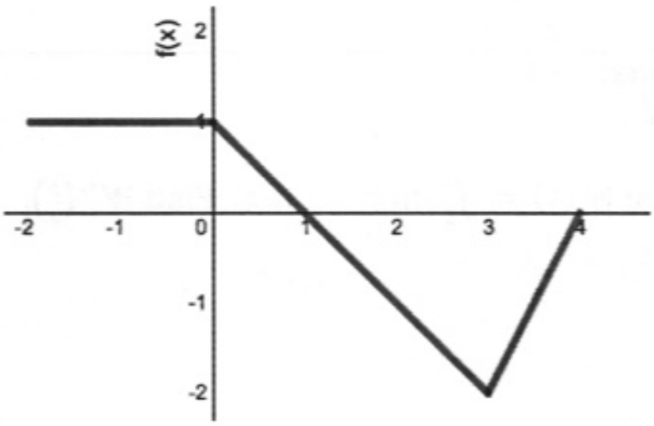
Circuit Training – Fundamental Theorem of Calculus, Part I Name ________________

Directions: Beginning in cell #1, use the Fundamental Theorem of Calculus Part I (and occasionally Part II) to answer the question. Search for your answer and that problem becomes #2. Continue in this manner until you complete the circuit.
NOTE: Any questions about the function $H(t)$ pertain to the following given information…

Let $H(t) = \int_1^t f(x)dx$ where $f(x)$ is the continuous function composed of three line segments with domain $[-2, 4]$ as graphed below:



$H(t) = \int_1^t f(x)\,dx$

$H'(t) = f(t)$

$H''(t) = f'(t)$

$\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2}$

$\frac{3\pi}{2}$ -1

$\sec^2\frac{\pi}{4} = \frac{2}{\sqrt{2}}$

Answer: $-\frac{5}{2}$ ✓

__1__ Let $F(x) = \int_0^x 5dt$. Find $F(3)$.

$F(3) = 5x\Big]_0^3$

$= 5(3) - 5(0)$

$= 15$

Answer: $\frac{2}{3}$ ✓

__8__ Find $\frac{d}{dt}\int_{-1}^{\tan t} \frac{2}{1+x^2}dx$ and evaluate it for $t = -\frac{\pi}{4}$.

$\frac{d}{dt}\int_{-1}^{\tan t} \frac{2}{1+x^2} = \frac{2}{1+(\tan t)^2} =$

$t = \frac{-\pi}{4} \Rightarrow \frac{2}{1+(\tan -\frac{\pi}{4})^2} = \frac{2}{1(-1)^2} = \frac{2}{1}$

$= 2$

Answer: 1 ✓

__5__

Find $F'\left(\frac{3\pi}{2}\right)$ given $F(t) = \int_5^t \frac{2x}{\pi}e^{\cos x}dx$.

$F'(t) = \frac{d}{dt}\left(\int_5^t \frac{2x}{\pi}e^{\cos x}dx\right)$

$= \frac{2t}{\pi}e^{\cos t}\,dt$

$F'\left(\frac{3\pi}{2}\right) = \frac{2\left(\frac{3\pi}{2}\right)}{\pi}e^{\cos\left(\frac{3\pi}{2}\right)} = 3e^0 = 3.$

Answer: -2 ✓

__11__ $H''(1) = ?$

$m = \frac{-2-1}{3-0} = \frac{-3}{3} = -1$

$H''(1) = f'(1)$

$= -1$

Answer: -1 ✓

12 $H(-2) = ?$

$H(t) = \int_1^t f(x)\,dx$

$H(-2) = -\left[2 + \frac{1}{2}\right]$

$= -\frac{5}{2}$

Answer: 4 ✓

4

$$G(x) = \int_{-2}^{x} \cos\left(\theta + \frac{\pi}{2}\right) d\theta. \quad G'\left(-\frac{\pi}{2}\right) =$$

$G'(x) = \cos\left(x + \frac{\pi}{2}\right)$

$G'\left(-\frac{\pi}{2}\right) = \cos\left(-\frac{\pi}{2} + \frac{\pi}{2}\right)$

$= \cos 0$

$= 1$

Answer: 15 ✓

2

Let $G(x) = \int_x^2 t\,dt$. Find $G(4)$.

$G(x) = -\int_2^x t\,dt$

$G(4) = -\left(\frac{1}{2}t^2\right)\Big|_2^4$

$= -\left(\frac{1}{2}(4)^2 - \frac{1}{2}(2)^2\right) = -6$

Answer: -3 ✓

7

Given $W(t) = \int_2^t \ln(x-1)dx$. Find $W''\left(\frac{5}{2}\right)$.

$W'(t) = \frac{d}{dt}\int_2^t \ln(x-1)\,dx$

$= \ln(t-1)$

$W''(t) = \frac{1}{t-1} \cdot 1$

$W''\left(\frac{5}{2}\right) = \frac{1}{\frac{5}{2}-1} = \frac{1}{\frac{3}{2}} = \frac{2}{3}.$

Answer: 3 ✓

6

The position function, $s(t)$, is defined as $s(t) = s(0) + \int_0^t \left(\frac{8}{\pi} + \sec^2\beta\right) d\beta$ where $s(0) = -6$. Find $s\left(\frac{\pi}{4}\right)$.

$S(t) = S(0) + \left[\frac{8}{\pi}t + \sec^2 t\right]_0^t$

$S\left(\frac{\pi}{4}\right) = -6 + \left[\frac{8}{\pi}\left(\frac{\pi}{4}\right) + \sec^2\left(\frac{\pi}{4}\right)\right]$

$= -6 + (2+1)$

$= -6 + 3$

$= 3$

Answer: 0 ✓

10 Now evaluate $H'(3)$.

$H'(t) = f(t)$

$H'(3) = f(3)$

$= -2$

Answer: 2 ✓

9 The next questions are about $H(t)$. Evaluate $H(1)$.

$H(t) = \int_1^t f(x)\,dx$

$H(1) = \int_1^1 f(x)\,dx$

$= 0$

Answer: -6 ✓

3

Let $F(x) = \int_3^x \sqrt{1+t}\,dt$. Find $F'(15)$.

$F'(x) = \frac{d}{dx}\left(\int_3^x \sqrt{1+t}\,dt\right)$

$= \sqrt{1+x}$

$F'(15) = \sqrt{1+15}$

$= 4$