AP Calculus AB | Name: ______________________
Section 6.6 – Worksheet KEY | Date: __________ Block: ________

Find the derivative for each of the following, by applying FTOC.

1. $g(x)=\int_1^x (t^2-1)^{20}\,dt$

$g'(x) = ((x)^2-1)^{20}(1) - ((1)^2-1)^{20}(0)$
$g'(x) = (x^2-1)^{20}$

2. $g(x)=\int_{-1}^x \sqrt{t^3+1}\,dt$

$g'(x) = \sqrt{(x)^3+1}(1) - \sqrt{(-1)^3+1}(0)$
$g'(x) = \sqrt{x^3+1}$

3. $g(u)=\int_\pi^u \frac{1}{1+t^4}\,dt$

$g'(u) = \frac{1}{1+(u)^4}(1) - \frac{1}{1+(\pi)^4}(0)$
$g'(u) = \frac{1}{1+u^4}$

4. $f(x)=\int_x^2 \cos(t^2)\,dt$

$f'(x) = \cos((2)^2)(0) - \cos((x)^2)(1)$
$f'(x) = -\cos(x^2)$

5. $h(x)=\int_2^{1/x} \sin^4 t\,dt$

$h(x) = \int_2^{x^{-1}} \sin^4 t\,dt$

$h'(x) = \sin^4(x^{-1})(-x^{-2}) - \sin^4(2)(0)$

$h'(x) = -\frac{\sin^4\left(\frac{1}{x}\right)}{x^2}$

6. $g(x)=\int_1^{\sqrt{x}} \frac{s^2}{s^2+1}\,ds$

$g(x) = \int_1^{x^{\frac{1}{2}}} \frac{s^2}{s^2+1}\,ds$

$g'(x) = \frac{\left(x^{\frac{1}{2}}\right)^2}{\left(x^{\frac{1}{2}}\right)^2+1}\left(\frac{1}{2}x^{-\frac{1}{2}}\right) - \frac{(1)^2}{(1)^2+1}(0)$

$g'(x) = \frac{x}{x+1}\left(\frac{1}{2\sqrt{x}}\right)$
$g'(x) = \frac{x}{2\sqrt{x}(x+1)}$

7. $y=\int_{\tan x}^{\pi/2} \sin(t^4)\,dt$

$y' = \sin\left(\left(\frac{\pi}{2}\right)^4\right)(0) - \sin((\tan x)^4)(\sec^2 x)$
$y' = -\sin(\tan^4 x)\sec^2 x$

8. $y=\int_{-5}^{\sin x} t\cos(t^3)\,dt$

$y' = (\sin x)\cos((\sin x)^3)(\cos x) - (-5)\cos((-5)^3)(0)$
$y' = \cos(\sin^3 x)\sin x\cos x$

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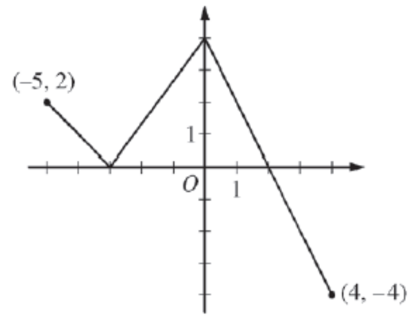
Given the graph of *f* which consists of three line segments as shown on [-5,4].
Let g be the function given by:

$$g(x)=\int_{-3}^{x} f(t)dt$$



Graph of f

Determine the following.

1.) $g(0)=\int_{-3}^{0} f(t)dt=6$ 2.) $g(2)=\int_{-3}^{2} f(t)\,dt=10$ 3.) $g(-3)=\int_{-3}^{-3} f(t)\,dt=0$

4.) $g(4)=\int_{-3}^{4} f(t)\,dt=6$ 5.) $g(-5)=\int_{-3}^{-5} f(t)dt=-\int_{-5}^{-3} f(t)\,dt=-2$

6. On what interval(s) of x is g increasing (if any)? $[-5,-3)\cup(-3,2)$

7. On what interval(s) of x is g decreasing (if any)? $(2,4]$

8. At what value(s) of x does g have a local maximum (if any)? $x=2$

9. At what value(s) of x does g have a local minimum (if any)? None

10. At what value of x does g have an absolute maximum? What is the abs. maximum? $x=2, y=10$

11. At what value of x does g have an absolute minimum? What is the abs. minimum? $x=-5, y=-2$

12. At what value(s) of x does g have a point of inflection (if any)? $x=-3, 0$

13.) $g'(0)=f(0)=4$ 14.) $g'(2)=f(2)=0$ 15.) $g'(-4)=f(-4)=1$

16.) $g'(4)=f(4)=-4$

17.) $g''(-1)=f'(-1)=\frac{4}{3}$ 18.) $g''(1)=f'(1)=-2$ 19.) $g''(-4)=f'(-4)=-1$

20. $\lim_{x\to-3}\frac{g(x)}{x^2-9}=\lim_{x\to-3}\frac{\int_{-3}^{-3} f(t)dt}{x^2-9}=\frac{0}{(-3)^2-9}=\frac{0}{0}$ So now we can apply L'Hopital's Rule

$\lim_{x\to-3}\frac{f(x)}{2x}=\frac{f(-3)}{2(-3)}=\frac{0}{-6}=0$

21. Write the equation of the tangent line to the graph of ***g.***

a) at x =2

$g(2)=\int_{-3}^{2} f(t)\,dt=10$
$g'(2)=f(2)=0$
$y-g(x_1)=g'(x_1)(x-x_1)$
$y-10=0(x-2)$
$y=10$

b) at x = -5

$g(-5)=\int_{-3}^{-5} f(t)\,dt=-\int_{-5}^{-3} f(t)\,dt=-2$
$g'(-5)=f(-5)=2$
$y-g(x_1)=g'(x_1)(x-x_1)$
$y-(-2)=2(x-(-5))$
$y+2=2(x+5)$
$y=2x+8$