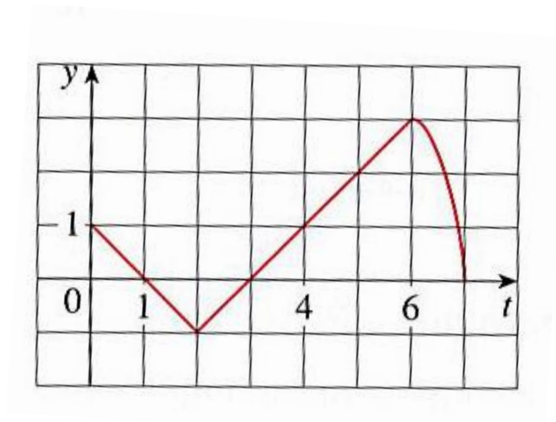
AP Calculus
Fundamental Theorem of Calculus

Name________________________
Integration Day 6

1. Let $g(x)=\int_0^x f(t)dt$, where f is the function whose graph is shown.



A.) Evaluate g(x) for
x=0

x=1

x=2

x=3

x=4

x=5

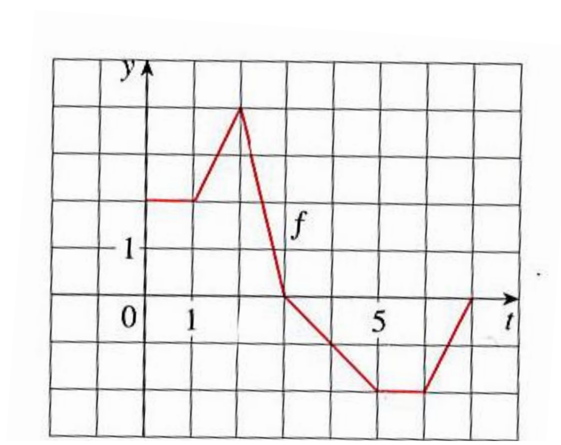
x=6

B.) Estimate g(7)

C.) Where does g have a maximum value? Where does it have a minimum value?

D.)Sketch a rough graph of g.

2. Let $g(x)=\int_0^x f(t)dt$, where f is the function whose graph is shown.



A.) Evaluate
g(0)

g(1)

g(2)

g(3)

g(6)

B.)On what intervals is g increasing?

C.)Where does g have a maximum value?

D.)Sketch a rough graph of g.

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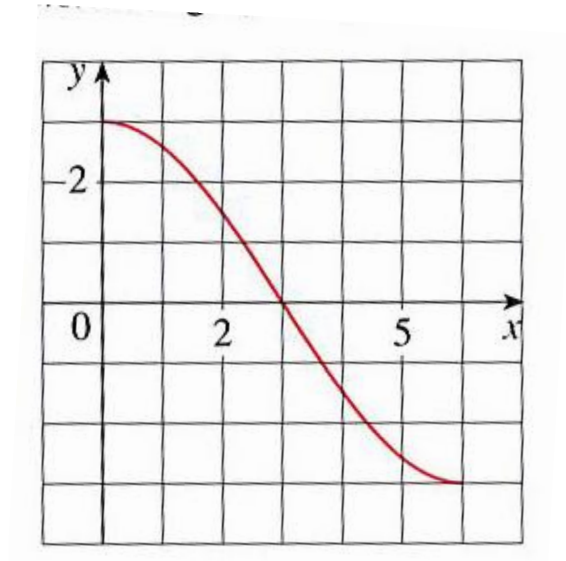
3. Let $g(x)=\int_0^x f(t)dt$, where f is the function whose graph is shown.



A.) Evaluate

g(0)

g(6)

B.) Estimate g(x) for

x=1

x=2

x=3

x=4

x=5

C.) On what interval is g increasing?

D.) Where does g have a maximum value?

E. Sketch a rough graph of g.

4-15: Use the 1st Fundamental Theorem of Calculus to find the derivative of the functions.

4. $g(x)=\int_1^x \frac{1}{t^3+1}dt$

5. $g(x)=\int_3^x e^{t^2-t}\,dt$

6. $g(s)=\int_5^s \left(t-t^2\right)^8 dt$

7. $g(r)=\int_0^r \sqrt{x^2+4}\,dx$

8. $G(x)=\int_x^1 \cos\sqrt{t}\,dt$

9. $h(x)=\int_1^{e^x} \ln t\,dt$

10. $h(x)=\int_1^{\sqrt{x}} \frac{z^2}{z^4+1}dz$

11. $y=\int_0^{\tan x} \sqrt{t+\sqrt{t}}\,dt$

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12. $y = \int_0^{x^4} \cos^2\theta \, d\theta$

13. $y = \int_{1-3x}^{1} \frac{u^3}{1+u^2} du$

14. $y = \int_{\sin x}^{1} \sqrt{1+t^2} \, dt$

15. $F(x) = \int_x^{\pi} \sqrt{1+\sec t} \, dt$

16. If $f(x) = \int_0^x (1-t^2)e^{t^2} dt$, on what interval is f increasing?

17. On what interval is the curve $y = \int_0^x \frac{t^2}{t^2+t+2} dt$ concave down?

18. If $f(x) = \int_0^{\sin x} \sqrt{1+t^2} dt$ and $g(y) = \int_3^y f(x) dx$, find $g''\left(\frac{\pi}{6}\right)$.

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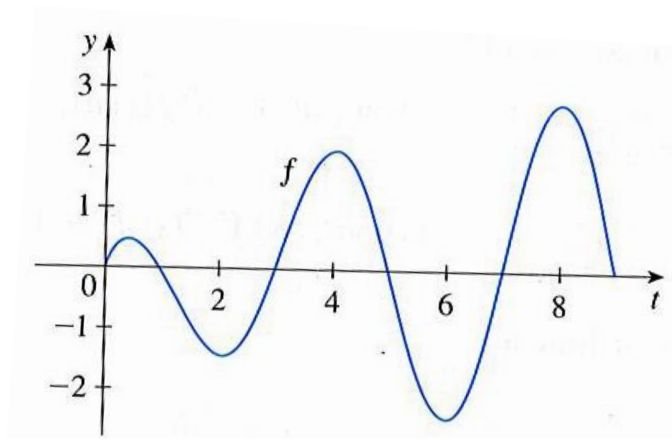
19. If f(1)=12, f' is continuous, and $\int_1^4 f'(x)dx = 17$, what is the value of f(4)?

20. Let $g(x) = \int_0^x f(t)dt$, where f is the function whose graph is shown.



A.) At what values of x doe the local maximum and minimum of g occur?

B.) Where does g attain its absolute maximum value?

C.) On what intervals is g concave downward?

D.) Sketch the graph of g.

Answers:

1.) a) $g(0)=0, g(1)=.5, g(2)=0, g(3)=-.5$, $g(4)=0, g(5)=1.5, g(6)=4$ b) $g(7)\approx 6.25$ c) $\max: x=1$, $\min: x=3$ d) sketch

2.) a) $g(0)=0, g(1)=2, g(2)=5, g(3)=7$, $g(6)=3$ b) $(0,3)$ c) $\max: x=3$ d) sketch

3.) a) $g(0)=0, g(6)=0$ b) $g(1)\approx 2.8, g(2)\approx 5$, $g(3)\approx 5.8, g(4)\approx 5$, $g(5)\approx 2.8$ c) $(0,3)$ d) $\max: x=3$ e) sketch

4.) $g'(x) = \frac{1}{x^3+1}$ 5.) $g'(x) = e^{x^2-x}$ 6.) $g'(s) = \left(s-s^2\right)^8$ 7.) $g'(R) = \sqrt{R^2+4}$

8.) $G'(x) = -\cos\sqrt{x}$ 9.) $h'(x) = xe^x$ 10.) $h'(x) = \frac{x}{2\sqrt{x}\left(x^2+1\right)}$ 11.) $y' = \sec^2 x\sqrt{\tan x + \sqrt{\tan x}}$

12.) $y' = 4x^3\cos^2\left(x^4\right)$ 13.) $y' = \frac{3(1-3x)^3}{1+(1-3x)^2}$ 14.) $h'(x) = \frac{x}{2\sqrt{x}\left(x^2+1\right)}$ 15.) $y' = \sec^2 x\sqrt{\tan x + \sqrt{\tan x}}$

16.) Increasing $(-1,1)$ 17.) Concave down $(-4,0)$ 18.) $g''\left(\pi/6\right) = \frac{\sqrt{15}}{4}$ 19.) $f(4) = 29$

20.) max: $x = 1$ & 5 Min: $x = 3$ & 9 b) Abs max: $x = 9$ c) concave down: $(.5,2),(4,6)$ & $(8,9)$ d) sketch