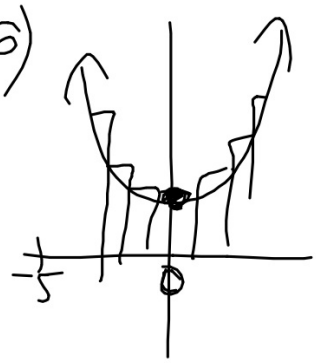
4) $\int_a^{2t} f(x) = F(2t) - F(a)$.

$\frac{d}{dx}\int_a^{2t} f(x) \neq f(x)$

$= 2f(2t)$

5)



6) $F'(x)=\sqrt{1+x^3}$ $\quad F(1)=5$, $F(3)$?

$$\int_1^3 \sqrt{1+x^3}\,dx = F(3)-F(1) \approx 6.22\ldots$$

5

7) $\frac{d}{dx}F(x) = \frac{d}{dx}\int_2^x \sqrt[3]{t^3-1}\,dt$

$F'(2) = \sqrt[3]{x^3-1}$

$= \sqrt[3]{2^3-1} = \boxed{\sqrt[3]{7}}$

8) $\frac{d}{dx}F(x) = \frac{d}{dx}\int_{3x}^{\sqrt{\pi}} \cos t^2\, dt$

$0 - 3\cos(3x)^2$

$= -3\cos 9x^2$

$\int 6x \sin x^2\, dx$ $\quad u = x^2$, $3du = 6x\, dx$

$= 3\int \sin u\, du$

$= -3\cos x^2 + C$

10).

x	0	3	6
$f(x)$	1	5	7
$f'(x)$	9	11	-4

$$g(x) = \int_0^{2x} f(t)\,dt$$

$$g'(x) = 2f(2x)$$

$$g''(x) = 2f'(2x)\cdot 2 = 4f'(2x)$$

$$g'(3) = 2f(2(3)) = 2f(6) = 2(7) = \boxed{14}$$

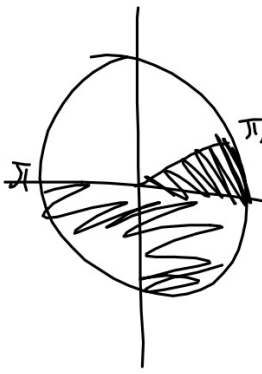
$$g''(3) = 4f'(2(3)) = 4f'(6) = \boxed{-16}$$

11) $v(t) = \frac{1}{2} - \sin t$, $0 \le t \le 2\pi$

a) $\frac{1}{2} - \sin t > 0$

$+\sin t \quad +\sin t$

$\frac{1}{2} > \sin t.$



$(0, \pi/6) \cup [\pi, 2\pi]$

b) $\int_0^{2\pi} \frac{1}{2} - \sin t \, dt.$

$= (\pi + 1) - (1)$

$= \boxed{\pi}$

c) $v'(t) > 0$ or < 0 @ $\pi/4$

$v'(t) = -\cos t$

$v'(\pi/4) = -\cos(\pi/4) < 0$

del.

(2) $\int 4x\sqrt{x-1}\,dx = 4\int x(x-1)^{1/2}\,dx$ $u = x-1 \Rightarrow x = u+1$, $du = 1\,dx$

$\Rightarrow 4\int (u+1)(u)^{1/2}\,du = 4\int u^{3/2} + u^{1/2}\,du.$

$= 4\left(\frac{2}{5}u^{5/2} + \frac{2}{3}u^{3/2}\right)$

$= \frac{8}{5}(x-1)^{5/2} + \frac{2}{3}(x-1)^{3/2} + C$

Bonus: $6t^2+1$ gal/min. for $0 \le t \le 2$ t in min.

at $t=2$, 32 gal.

at $t=1$ = ?

$$f(x) = \int 6t^2+1 \, dt.$$

$$= 2t^3 + t + C$$

$$32 = 2(2)^3 + 2 + C$$

$$14 = C$$

$$f(x) = 2t^3 + t + 14$$

$$= 2(1)^3 + 1 + 14$$

$$= 17 \text{ gal}$$

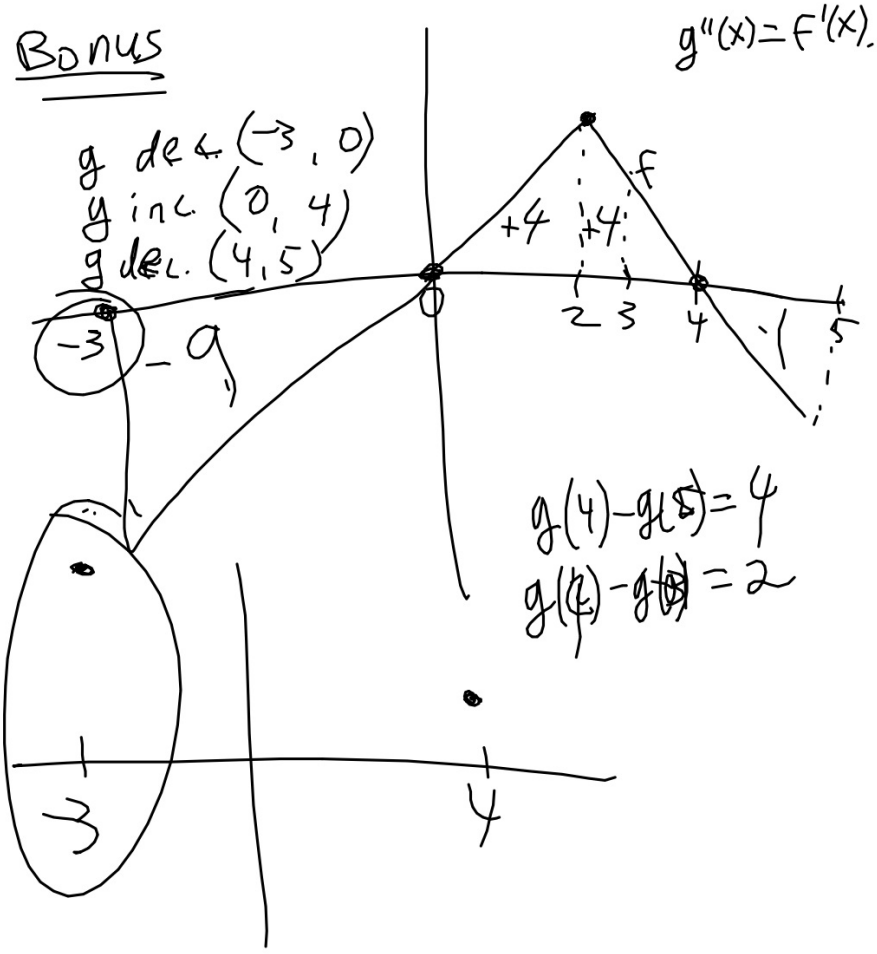
Bonus

$g''(x) = f'(x)$. $g(x) = \int_2^x f(t)\,dt$.

$-3 \le x \le 5$

$g'(x) = f(x)$

g dec. $(-3, 0)$
g inc. $(0, 4)$
g dec. $(4, 5)$



a) $t = 4$

b) Abs. max

$g(4)$

$g(3)$

$g(5)$

$g(4) - g(5) = 4$

$g(\quad) - g(\quad) = 2$

c) $(-3, 2)$.