24. $\int_2^3 (x^2+5)\,dx$

1. $\lim\limits_{\|\Delta\|\to 0} \sum_{i=1}^{n} (c_i^2+5)\Delta x_i$

2. $\lim\limits_{\|\Delta\|\to 0} \sum_{i=1}^{n} c_i(2c_i^2+1)\Delta x_i$

$= \int_2^3 x(2x^2+1)\,dx$

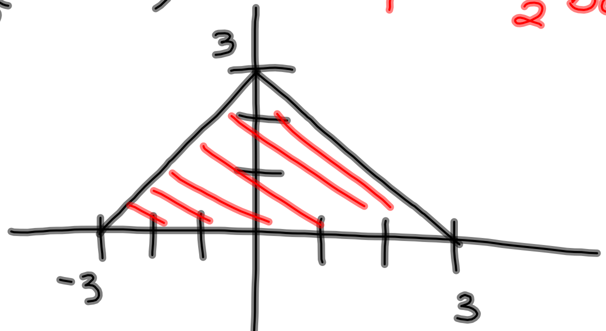
25. $\int_0^3 f(x) = 5$, $\int_3^7 f(x) = 11$

3) $\int_7^0 f(x)\,dx = -\int_0^7 f(x)\,dx$

$= -\left[\int_0^3 + \int_3^7\right] = -16$

22. $|x| = \begin{cases} x, & x \geq 0 \\ -x, & x < 0 \end{cases}$

$\int_{-3}^{3} (3 - |x|)\,dx = 9 = \frac{1}{2}\,\text{base} \cdot \text{height}$



$3 - x$

$3 + x$

$\int_{-3}^{0} (3+x)\,dx + \int_{0}^{3} (3-x)\,dx$

20. $\int_{1}^{3} (2x+5)\,dx$

$\lim_{n\to\infty} \sum_{i=1}^{n} \left[2\left(1 + \frac{2i}{n}\right) + 5 \right] \cdot \frac{3-1}{n}$

$= \lim_{n\to\infty} \frac{2}{n} \sum_{i=1}^{n} \left(2 + \frac{4i}{n} + 5\right)$

$= \lim_{n\to\infty} \left[\frac{2}{n} \sum_{i=1}^{n} 7 + \frac{8}{n^2} \sum_{i=1}^{n} i \right]$

$= \lim_{n\to\infty} \left[\frac{2}{n} \cdot 7n + \frac{8}{n^2} \cdot \frac{n(n+1)}{2} \right]$

$= 14 + 4 = \boxed{18}$

$\int_{1}^{3} (2x+5)\,dx = x^2 + 5x \Big|_{1}^{3} =$

$(9 + 15) - (1 + 5) = 24 - 6 = \boxed{18}$

4.1

70. balloon rises vertically
@ 16 ft/s $= v(0)$
releases sandbag 64 ft above ground $= s(0)$

(a) How many seconds after release will bag strike ground?

(b) @ what velocity will it hit ground?

$a(t) = -32\ ft/s^2$

$v(t) = -32t + 16$

$s(t) = -16t^2 + 16t + 64$

$v(t) = a_0 t + v_0$

$s(t) = \frac{1}{2}a_0 t^2 + v_0 t +$

(a) $-16t^2 + 16t + 64 = 0$

$-16(t^2 - t - 4) = 0$

$t^2 - t - 4 = 0$

$t = \frac{1 \pm \sqrt{1 - 4(1)(-4)}}{2} = \frac{1 \pm \sqrt{17}}{2}$

$\boxed{\frac{1+\sqrt{17}}{2}\ s}$ ≈ 2.56

(b) $v\left(\frac{1+\sqrt{17}}{2}\right) = \boxed{-32\left(\frac{1+\sqrt{17}}{2}\right) + 16\ ft/s} \approx -6$

78. $x(t) = (t-1)(t-3)^2$, $0 \le t \le 5$

(a) find $a(t)$ & $v(t)$

(b) find open t-intervals on which particle is moving to the right

(c) find $v(t)$ when $a(t) = 0$

$x(t) = (t-1)(t^2 - 6t + 9)$

$= t^3 - 6t^2 + 9t - t^2 + 6t - 9$

$= t^3 - 7t^2 + 15t - 9$

$\boxed{v(t) = 3t^2 - 14t + 15}$

$\boxed{a(t) = 6t - 14}$

$3t^2 - 14t + 15$

$3t^2 - 9t - 5t + 15$

$3t(t-3) - 5(t-3)$

$(t-3)(3t-5)$

$3t^2 - 14t + 15 > 0$

0 2 4

$+ \quad 5/3 \quad - \quad 3 \quad +$

moving to the right on $(0, 5/3) \cup (3, 5)$

$a(t) = 0$ when $t = 7/3$

$v(7/3) = 3(7/3)^2 - 14(7/3) + 15 = \boxed{-4/3}$

4.1

58. $f'(s) = 6s - 8s^3$; $f(2) = 3$

$\boxed{f(s) = 3s^2 - 2s^4 + C}$ general solution

$3 = 3(2)^2 - 2(2)^4 + C$

$C = 3 - 12 + 32 = 23$

$\boxed{f(s) = 3s^2 - 2s^4 + 23}$ particular solution

4.4

1st Fundamental Theorem of Calculus

if F is antiderivative of f, & f is cts on $[a,b]$

$$\int_a^b f(x)dx = F(b) - F(a)$$

$\therefore$ f is the derivative of F

$F'(x) = f(x)$

Mean Value Theorem for Integrals

$$\int_a^b f(x)dx = f(c)(b-a)$$

if f is cts on $[a,b]$ $\exists\, c \in (a,b)$ s.t.

2nd Fundamental Theorem of Calculus

If f is cts on open interval containing a,

$$\frac{d}{dx}\left[\int_a^x f(t)\,dt\right] = f(x)$$

HW: #1-19