7N

#3

(a) $\dfrac{P(10) - P(0)}{10 - 0} = 112$ bac/day

(b) $\dfrac{dP}{dt} = 100 e^{0.25t} \cdot (0.25) = 25 e^{0.25t}$ (inner function)

(c) $\left.\dfrac{dP}{dt}\right|_{t=10} = 25 e^{.25(10)} = 25 e^{2.5}$

$= 305$ bac/day

7O #2 $s(t) = \underbrace{-16}_{\text{half of } -32 \text{ ft/sec}^2} t^2 + \underbrace{40}_{\text{initial velocity}} t + \underbrace{4}_{\text{initial height}}$

(b) $s(2) = -16(2)^2 + 40(2) + 4 = 84 - 64 = 20$ ft

(c)

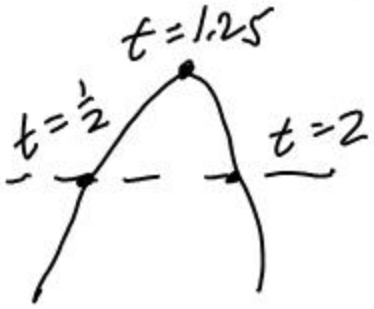
(c) $s'(t) = -16t^2 + 40t + 4 = 20$

$$\frac{-16t^2 + 40t - 16 = 0}{-8}$$

$$2t^2 - 5t + 2 = 0$$

$$(2t - 1)(t - 2) = 0$$

$t = \frac{1}{2}$ or $t = 2$



$v(0) = 40$ ft/sec

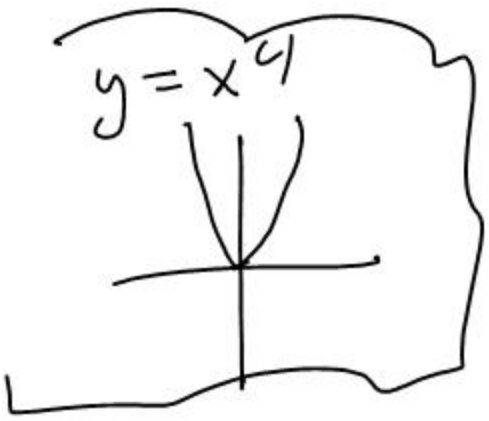
(d) $\frac{ds}{dt} = v(t) = -32t + 40$

$-32t + 40 = 0$

$s(1.25) =$

$t = \frac{-40}{-32} = \frac{5}{4} = 1.25$ secs

17Q # 5. $f(x) = x^4 - 2x^2$



$f'(x) = 4x^3 - 4x = 0$

$4x(x^2 - 1) = 0$

$4x(x-1)(x+1) = 0$

critical values of f ↗ $x = 0$ or $x = 1$ or $x = -1$

$f'(x)$: − | + | − | +

f ↗ decr. at -1, incr. at 0, decr. at 1, incr.

f is increasing on $(-1, 0) \cup (1, \infty)$

f is decreasing on $(-\infty, -1) \cup (0, 1)$

17R # 4. Max at $x = 0$

Min at $x = -1$ and $x = 1$

Find the intervals where $f(x) = x^4 - 2x^2$ is concave up and concave down.

$f'(x) = 4x^3 - 4x$

$f''(x) = 12x^2 - 4 = 0$

$x^2 = \frac{1}{3}$

$x = \pm \frac{1}{\sqrt{3}}$ ← hypercritical value

concave up: ∪

concave down: ∩

$f''(x)$: + on $(-\infty, -\frac{1}{\sqrt{3}})$, − on $(-\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}})$, + on $(\frac{1}{\sqrt{3}}, \infty)$

f is concave up on $(-\infty, -\frac{1}{\sqrt{3}}) \cup (\frac{1}{\sqrt{3}}, \infty)$

f is concave down on $(-\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}})$

There are <u>flex points</u> at $x = \pm \frac{1}{\sqrt{3}}$.

(points of inflection)

Ex. $2^5 = 32$ Ex. $\log_2 32 = 5$

Ex. $\sin \frac{\pi}{6} = \frac{1}{2}$ Ex. $\sin^{-1} \frac{1}{2} = \frac{\pi}{6}$

The Anti Derivative

Ex. $\frac{d}{dx}\left[x^2 + 4x\right] = 2x + 4$

Ex. $\int (2x + 4)\, dx = x^2 + 4x + C$

$x^2 + 4x + 9e^3$

Constant of integration

Ex $\int (4x^3 + 3x^2 - 5x + 2)\, dx$

$= x^4 + x^3 - \frac{5}{2}x^2 + 2x + C$

Ex. $\int \sin x \, dx = -\cos x + C$

$\int \cos x \, dx = \sin x + C$

$\int e^x \, dx = e^x + C$

Ex. $\int e^{2x} \, dx = \frac{1}{2} e^{2x} + C$

Ex. $\int x \cdot \cos x^2 \, dx = \frac{1}{2} \sin x^2 + C$

$\frac{d}{dx}[\sin x^2] = 2x \cos x^2$

7P # 3,4; 7Q # 8,9; 7R #3,6