$x(t) =$ position function

$s(t)$

calc.

$s'(t) =$ velocity

positive: right/up

negative: left/down

calc.

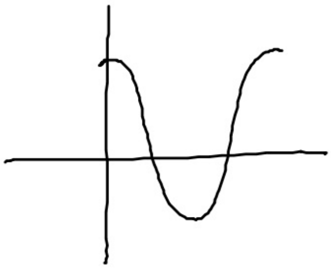
$s''(t) = v'(t) =$ acceleration

If $v(t) = 3\sin(t)$

and at $t=0,\ s(t) = 0$.

What is $s(t)$?

$s(t) = -3\cos(t) + C$



$t=0,$
$s(0)=0$

$s(0) = -3\cos(0) + C$

$0 = -3\cos(0) + C$

$0 = -3\cdot 1 + C$

$\boxed{s(t) = -3\cos(t) + 3}$

$0 = -3 + C$

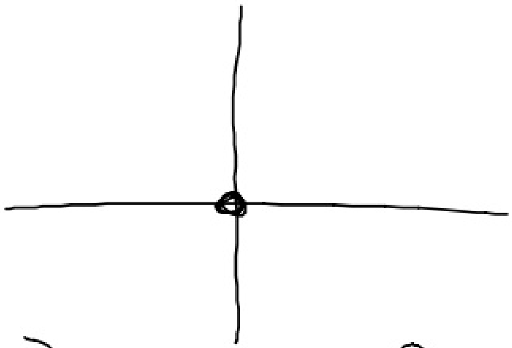
$\underline{C = 3}$

a.) $x'(t) = \underbrace{2\pi t}_{f} \cdot \underbrace{\cos(\pi t^2)}_{g}$ $\qquad 2\pi\left(\underbrace{t}_{f} \cdot \underbrace{\cos(\pi t^2)}_{g}\right)$

b.) $f'g + fg' = x''(t) = a(t)$

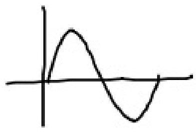
$2\pi \cdot \cos(\pi t^2) + 2\pi t \cdot -\sin(\pi t^2) \cdot 2\pi t$

$2\pi\cos(\pi t^2) - 4\pi^2 t^2 \sin(\pi t^2)$



$x(0)=0$

$v(0)=0$



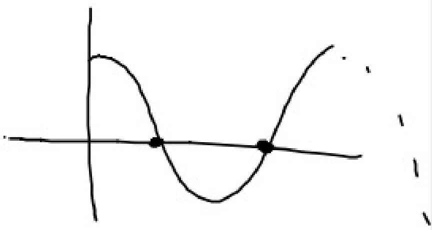
c.) velocity $= 0$

$$2\pi t \cdot \cos(\pi t^2) = 0$$

$t = 0$ $\qquad \cos(\pi t^2) = 0$

let $u = \pi t^2$

$$\cos(u) = 0$$



$$u = \frac{\pi}{2} + \pi n \qquad n \in \mathbb{N}$$

$\{1, 2, 3, 4, \ldots\}$

$$\frac{\cancel{\pi} t^2}{\cancel{\pi}} = \frac{\frac{1}{2}\cancel{\pi}}{\cancel{\pi}} + \frac{\cancel{\pi} n}{\cancel{\pi}}$$

$$\sqrt{t^2} = \sqrt{\frac{1}{2} + n}$$

$$t = \pm\sqrt{1/2 + n}$$

$$-1 \le t \le 1$$

t

$-\sqrt{1/2}, 0, \sqrt{1/2}$

a.) $v(t) = 1 - \sin(2\pi t)$

$v'(t) = a(t) = -2\pi\cos(2\pi t)$

b.) "at rest"

means

$v(t) = 0 = 1 - \sin(2\pi t)$

$1 = \sin(2\pi t)$

$\sin(u) = 1$

$u = \frac{1}{2}\pi$

$\frac{\cancel{2\pi} t}{\cancel{2\pi}} = \frac{\frac{1}{2}\cancel{\pi}}{2\cancel{\pi}} + \frac{\cancel{2\pi} n}{\cancel{2\pi}}$

$t = \frac{1}{4} + n \in \{1, 2, 3, \ldots\}$

$t = 1/4,\ 5/4,$