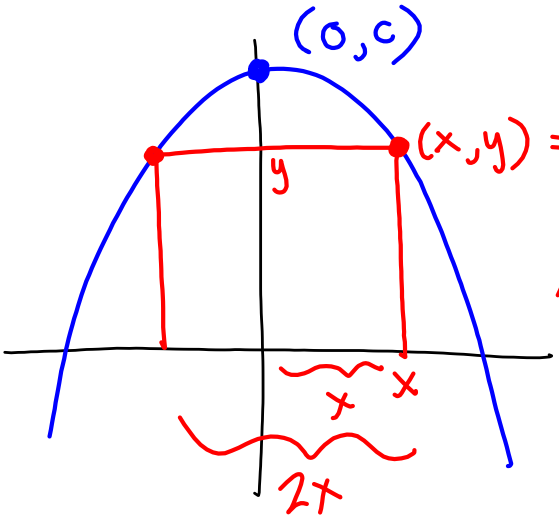


$y = -x^2 + c$

$(x, y) = x, -x^2 + c$

$A(x) = 2x(-x^2 + c)$

$A(x) = -2x^3 + 2xc$

$A'(x) = -6x^2 + 2c$

$-6x^2 + 2c = 0$

$2c = 6x^2$

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

$\pm\sqrt{c/3} = x$

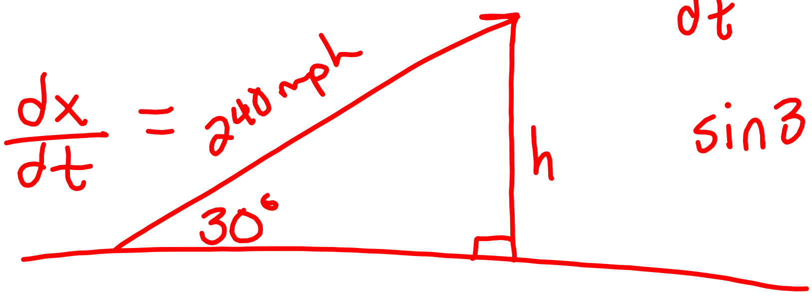
width $= 2x$

$= \boxed{2\sqrt{c/3}}$

height $= -x^2 + c$

$= -\frac{c}{3} + c = \boxed{\frac{2c}{3}}$

12. An airplane is flying in still air with an airspeed of 240 miles per hour. If it is climbing at an angle of 30°, find the rate at which it is gaining altitude.



$\frac{dh}{dt} = ?$ $\frac{dx}{dt} = 240$

$\sin 30° = \frac{h}{x}$

$h = x \sin 30$

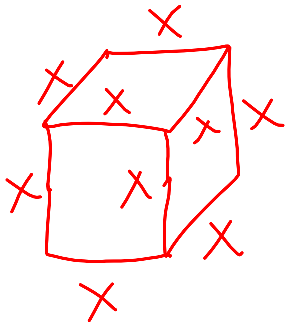
$h = \frac{x}{2}$

$\frac{dh}{dt} = \frac{1}{2}\frac{dx}{dt}$

$= \frac{1}{2}(240) = \boxed{120 \text{ mph}}$

10. All edges of a cube are expanding at a rate of 3 centimeters per second. How fast is the volume changing when each edge is 10 centimeters?

$\frac{dx}{dt} = 3\ cm/s$; $\frac{dV}{dt} = ?$ when $x = 10cm$



$V = x^3$

$\frac{dV}{dt} = 3x^2 \cdot \frac{dx}{dt} = 3(10)^2 \cdot (3)$

$= \boxed{900\ cm^3/s}$

17. Locate the absolute extrema on the closed interval.

$f(x) = x^3 - 12x, \qquad [0,4]$

18. Determine whether the Mean Value Theorem can be applied to f on the closed interval, and if so, find all values of c such that $f'(c) = \frac{f(b)-f(a)}{b-a}$.

$f(x) = \frac{x+1}{x}, \left[\frac{1}{2}, 2\right]$

17. $f'(x) = 3x^2 - 12$

$3(x^2 - 4) = 0$

$x = \pm 2$

$f(0) = 0$

$f(2) = 8 - 24 = -16 \leftarrow$ abs min

$f(4) = 64 - 48 = 16 \leftarrow$ abs max

19. Find the critical numbers of f (if any), find the open intervals on which the function is increasing or decreasing, and locate all relative extrema.

$f(x) = \frac{x^2 - 2x + 1}{x + 1}$

$f'(x) = \frac{(x+1)(2x-2) - (x^2-2x+1)}{(x+1)^2} = \frac{2x^2 - 2x + 2x - 2 - x^2 + 2x - 1}{(x+1)^2} = \frac{x^2+2x-3}{(x+1)^2}$

$f'(x) = \frac{(x+3)(x-1)}{(x+1)^2}$

$-3, 1, -1$

20. Find the points of inflection and discuss the concavity of the graph of the function.

$f(x) = 2x^4 - 8x + 3$

$f'(-4) \quad f'(-2) \quad f'(0) \quad f'(2)$

$+ \quad -3 \quad - \quad -1 \quad - \quad 1 \quad +$

rel max @ $(-3,-8)$

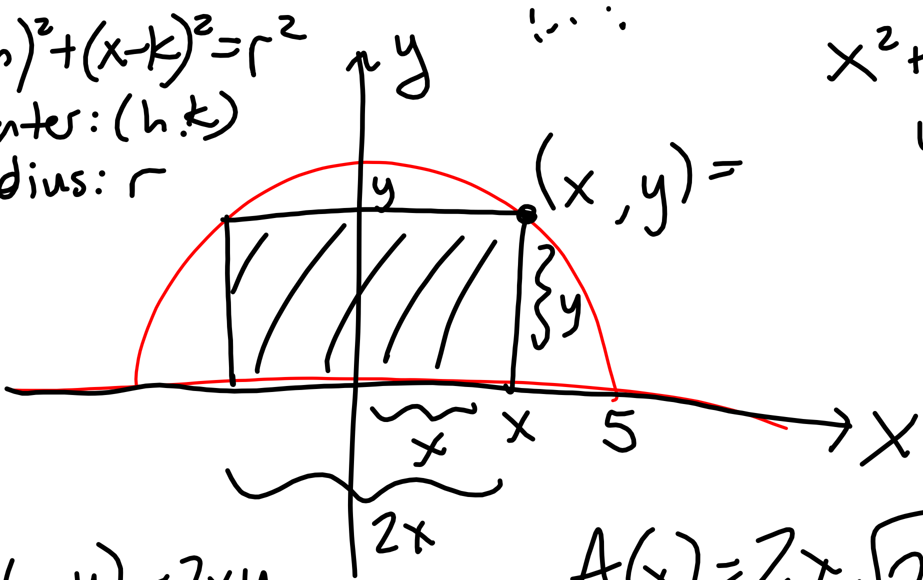
rel min @ $(1,0)$

f is increasing on $(-\infty,-3) \cup (1,\infty)$ & decreasing on $(-3,-1) \cup (-1,1)$

$(x-h)^2+(x-k)^2=r^2$

center: (h,k)

radius: r



$x^2+y^2=25$

$y^2=25-x^2$

$y=\sqrt{25-x^2}$

$A(x,y)=2xy$

$A(x)=2x\sqrt{25-x^2}$