

$$1. \quad g(x) = \int_0^x f(t) dt$$

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

Hence:

$$g \text{ increasing} \longleftrightarrow g' = f > 0$$

$(-2, 2)$

$$g \text{ decreasing} \longleftrightarrow g' = f < 0$$

$(-\infty, -2) \cup (2, \infty)$

$$g \text{ concave up} \longleftrightarrow g'' = f' > 0$$

$$\longleftrightarrow g' = f \text{ increasing}$$

$(-\infty, 0)$

$$g \text{ concave down} \longleftrightarrow g'' = f' < 0$$

$$\longleftrightarrow g' = f \text{ decreasing}$$

$(0, \infty)$

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2.

$$(a) \quad \int_{-1}^1 \frac{-1}{1+x^2} dx = -\tan^{-1}(x) \Big|_{-1}^1$$

$$= -\tan^{-1}(1) + \tan^{-1}(-1)$$

$$= -\frac{\pi}{4} + \left(-\frac{\pi}{4}\right)$$

$$= -\frac{\pi}{2}$$

(b) FTC 2 does not apply since there is no antiderivative of $\frac{-1}{x^2}$ at $x=0$.