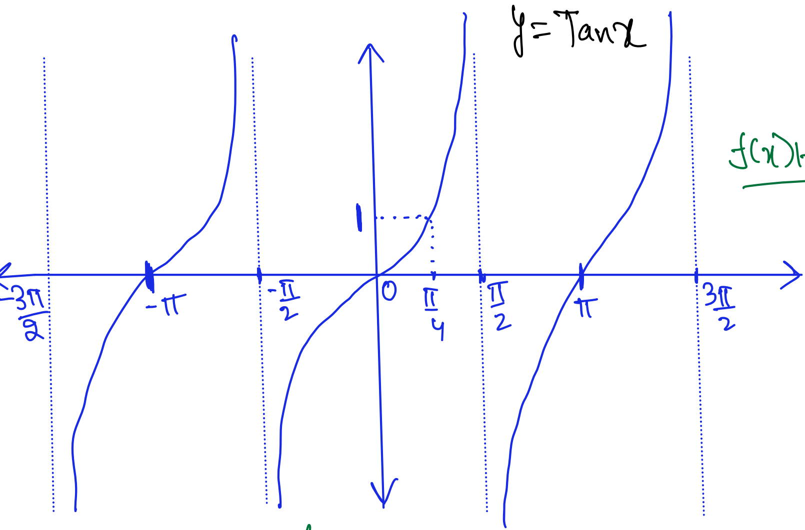
Section 1.3

(22) $y = \frac{1}{4}\operatorname{Tan}\left(x - \frac{\pi}{4}\right) \xleftarrow{f(x) \mapsto \frac{1}{4}f(x)} y = \operatorname{Tan}\left(x - \frac{\pi}{4}\right) \xleftarrow{x \mapsto x - \frac{\pi}{4}} y = \operatorname{Tan} x$

or

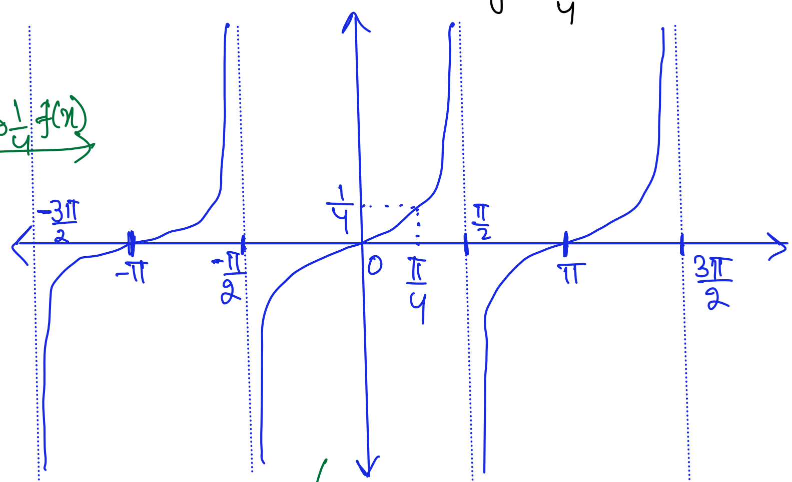
$y = \frac{1}{4}\operatorname{Tan}\left(x - \frac{\pi}{4}\right) \xleftarrow{x \mapsto x - \frac{\pi}{4}} y = \frac{1}{4}\operatorname{Tan} x \xleftarrow{f(x) \mapsto \frac{1}{4}f(x)} y = \operatorname{Tan} x$

$y = \operatorname{Tan} x$



$\xrightarrow{f(x) \mapsto \frac{1}{4}f(x)}$

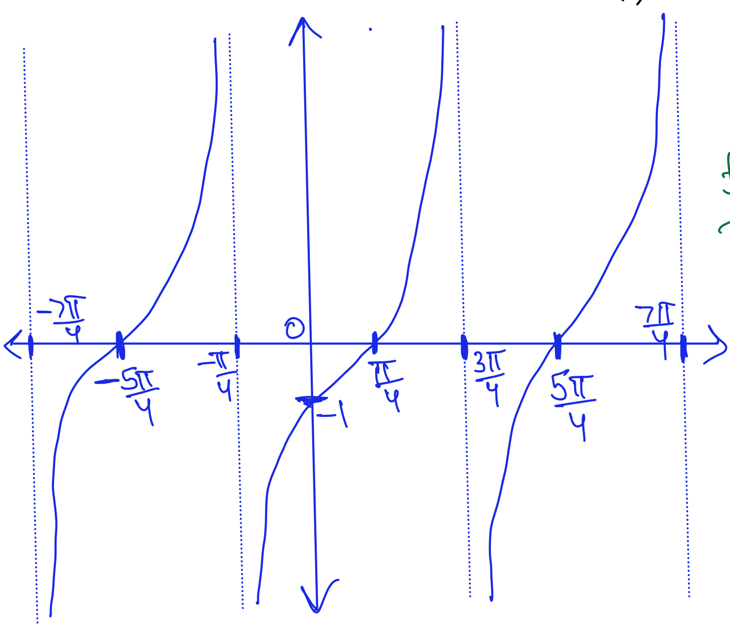
$y = \frac{1}{4}\operatorname{Tan} x$



$x \mapsto x - \frac{\pi}{4}$

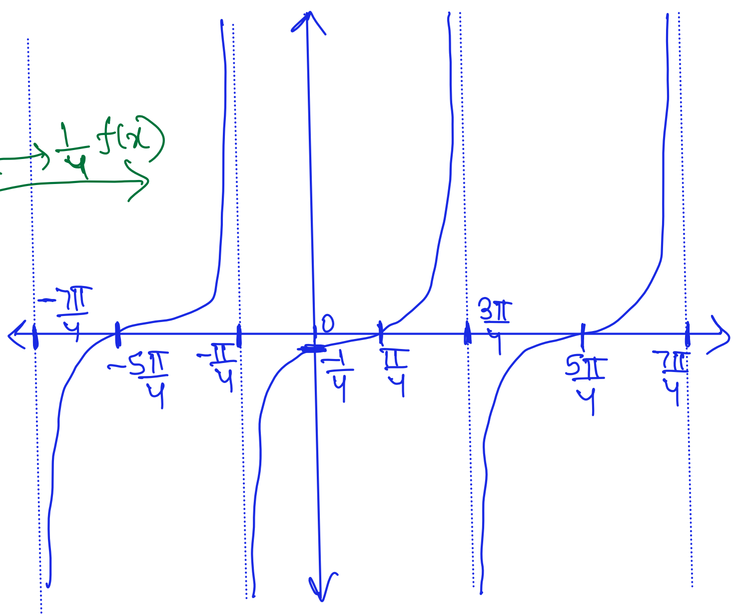
$x \mapsto x - \frac{\pi}{4}$

$y = \operatorname{Tan}\left(x - \frac{\pi}{4}\right)$



$\xrightarrow{f(x) \mapsto \frac{1}{4}f(x)}$

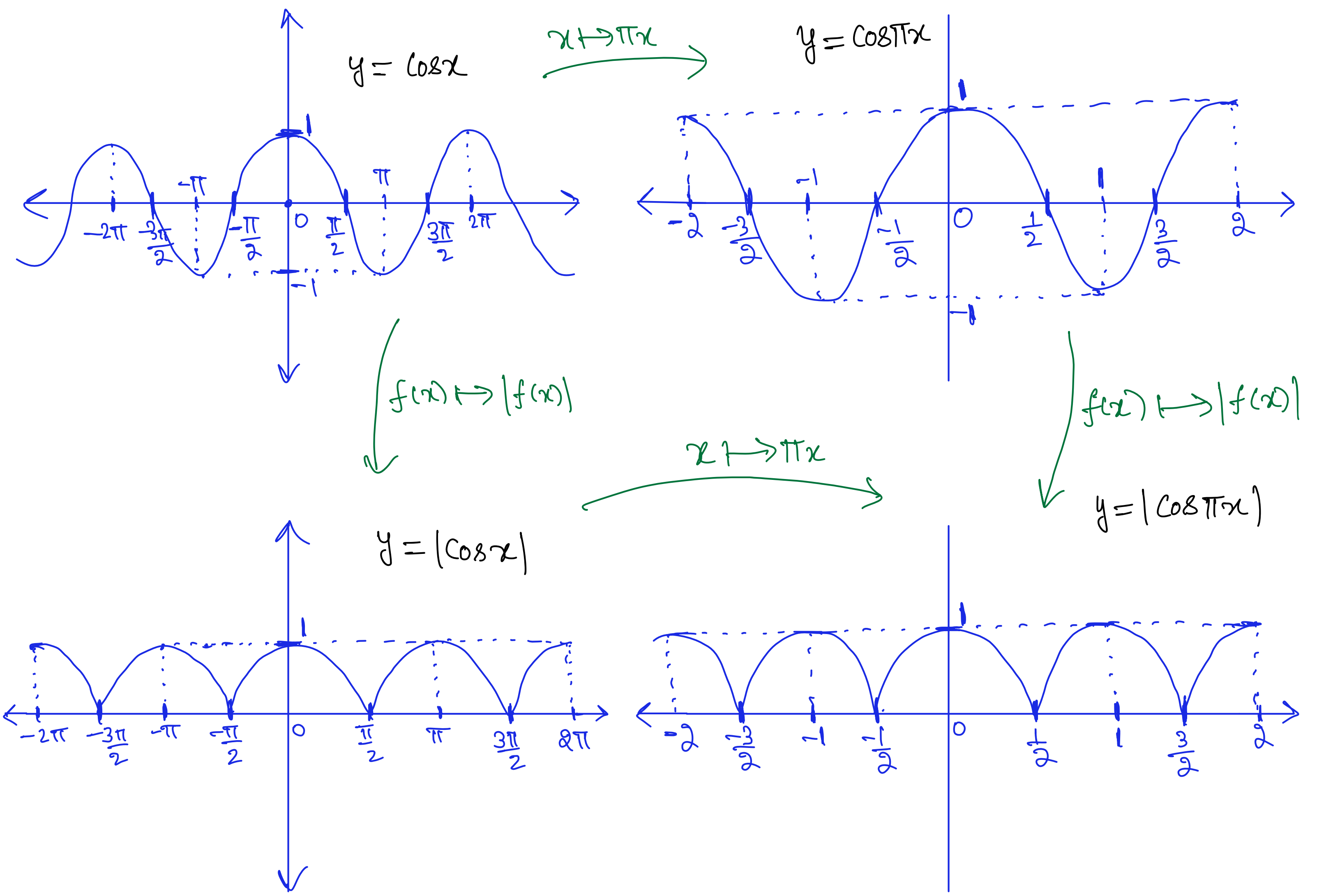
$\boxed{y = \frac{1}{4}\operatorname{Tan}\left(x - \frac{\pi}{4}\right)}$



(24) $y = |\cos \pi x| \xleftarrow{f(x) \mapsto |f(x)|} y = \cos \pi x \xleftarrow{x \mapsto \pi x} y = \cos x$

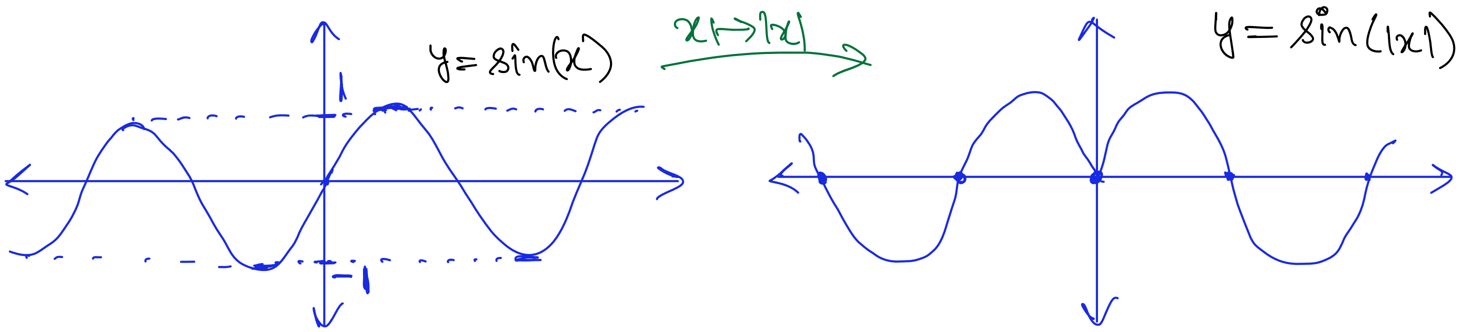
or

$y = |\cos \pi x| \xleftarrow{x \mapsto \pi x} y = |\cos x| \xleftarrow{f(x) \mapsto |f(x)|} y = \cos x$

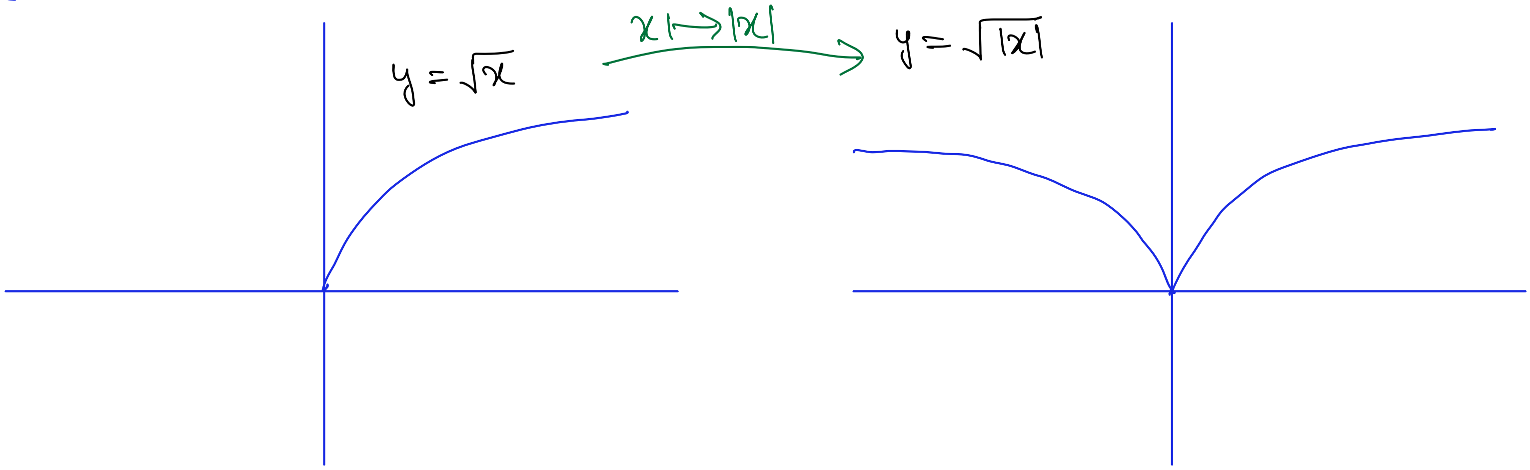


(29) (a) Given the graph of $y = f(x)$, the graph of $y = f(|x|)$ is obtained by replacing the portion of $y = f(x)$ in the left half plane (that is portion over $-$ve x-axis) with the mirror image of the portion of $y = f(x)$ in the right half plane. The mirror image is taken by considering the y-axis as a mirror.

(b) $y = \sin|x| \xleftarrow{x \mapsto |x|} y = \sin x$



(c) $y = \sqrt{|x|} \xleftarrow{x \mapsto |x|} y = \sqrt{x}$



(42) $f(x) = \operatorname{Tan} x$, $\quad g(x) = \dfrac{x}{x-1}$, $\quad h(x) = \sqrt[3]{x}$

$$(f \circ g \circ h)(x) = f \circ g(h(x)) = f \circ g\left(\sqrt[3]{x}\right)$$

$$= f\left(g\left(\sqrt[3]{x}\right)\right) = f\left(\frac{\sqrt[3]{x}}{\sqrt[3]{x} - 1}\right)$$

$$= \operatorname{Tan}\left(\frac{\sqrt[3]{x}}{\sqrt[3]{x} - 1}\right)$$

(48) $u(t) = \dfrac{\operatorname{Tan} t}{1 + \operatorname{Tan} t}$ $\rightarrow$ This is a rational function in Tant

$\Rightarrow$ we can take $g(t) = \operatorname{Tan} t$

Then $f(x) = \dfrac{x}{1+x}$

Check that $(f \circ g)(t) = f(g(t)) = \dfrac{g(t)}{1 + g(t)} = \dfrac{\operatorname{Tan} t}{1 + \operatorname{Tan} t} = u(t)$

Thus, for $f(x) = \dfrac{x}{1+x}$ and $g(x) = \operatorname{Tan} x$

we have $u(t) = (f \circ g)(t)$

Section 1.4

3) $P(2, -1)$, $Q\left(x, \frac{1}{1-x}\right)$

(a) $m_{PQ} = \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{\frac{1}{1-x} - (-1)}{x - 2} = \dfrac{\frac{1}{1-x} + 1}{x-2}$

$= \dfrac{1 + 1 - x}{(1-x)(x-2)} = \dfrac{2-x}{(1-x)(x-2)}$

x	1.5	1.9	1.99	1.999	2.5	2.1	2.01	2.001
m_{PQ}	2	1.111111	1.010101	1.001001	0.666667	0.909091	0.990099	0.999001

(b) $m_{PQ} \to 1$ as $Q \to P$

$\Rightarrow$ slope of tangent $= \lim_{Q \to P} m_{PQ} = 1$

(c) $\dfrac{y - (-1)}{x - 2} = 1 \Rightarrow y + 1 = x - 2 \Rightarrow x - y - 3 = 0$ is the eqn. of the tangent line.

5) $y(t) = 40t - 16t^2$

At $t = 2$, $y(2) = 40(2) - 16(2)^2 = 80 - 64 = 16$ ft

t	2.5	2.1	2.05	2.01
$y(t)$	0	13.44	14.76	15.7584
Δy	-16	-2.56	-1.24	-0.2416
Δt	0.5	0.1	0.05	0.01
$v_{av} = \frac{\Delta y}{\Delta t}$	-32	-25.6	-24.8	-24.16

$v_{\text{instantaneous}} = \lim_{\Delta t \to 0} \dfrac{\Delta y}{\Delta t} = -24$ ft/sec.

Section 1.5

(5)

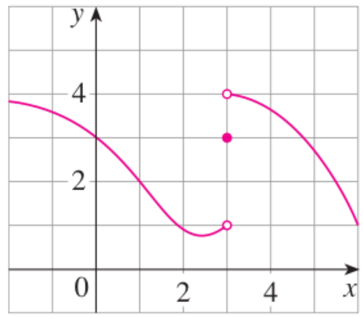
(a) $\lim_{x\to 1} f(x) = 2$

(b) $\lim_{x\to 3^-} f(x) = 1$

(c) $\lim_{x\to 3^+} f(x) = 4$

(d) $\lim_{x\to 3} f(x) =$ d.n.e. because LHL $\neq$ RHL

(e) $f(3) = 3$



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