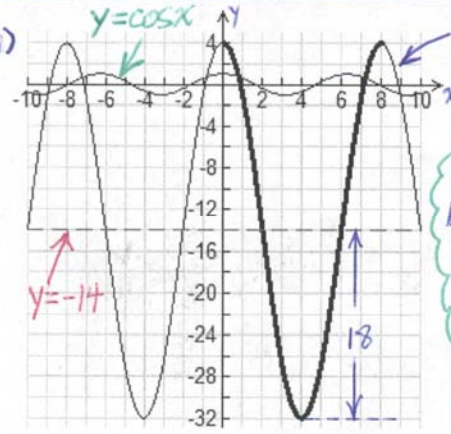
(a)




$y = 18\cos\left(\frac{\pi}{4}x\right) - 14 = 18\cos\left(\frac{\pi}{4}x\right) - 14$

$(x,y) \to \left(\frac{4}{\pi}x, 18y - 14\right)$

Period of $y=\cos x$ is stretched by a factor of $\frac{4}{\pi}$

$\therefore T = 2\pi\left(\frac{4}{\pi}\right) = 8$

$A = 18,\ d = -14,\ p = 0$

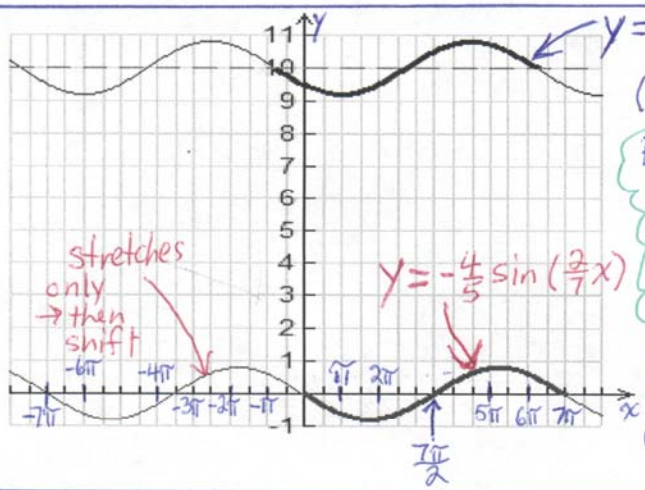
Horizontal
1. Stretch by factor of $\frac{4}{\pi}$
2. No shift

Vertical
1. Stretch by a factor of 18
2. Translate down 14 units

Suitable Scale for x-axis

$T = 8$, which is divisible by 4 $\therefore$ 1 square = 1 unit is a good choice

(b)




$y = -\frac{4}{5}\sin\left(\frac{2}{7}\left(x + \frac{3\pi}{4}\right)\right) + 10$

$(x,y) \to \left(\frac{7}{2}x - \frac{3\pi}{4}, -\frac{4}{5}y + 10\right)$

Period of $y=\sin x$ is stretched by a factor of $\frac{7}{2}$

$\therefore T = 2\pi\left(\frac{7}{2}\right) = 7\pi$

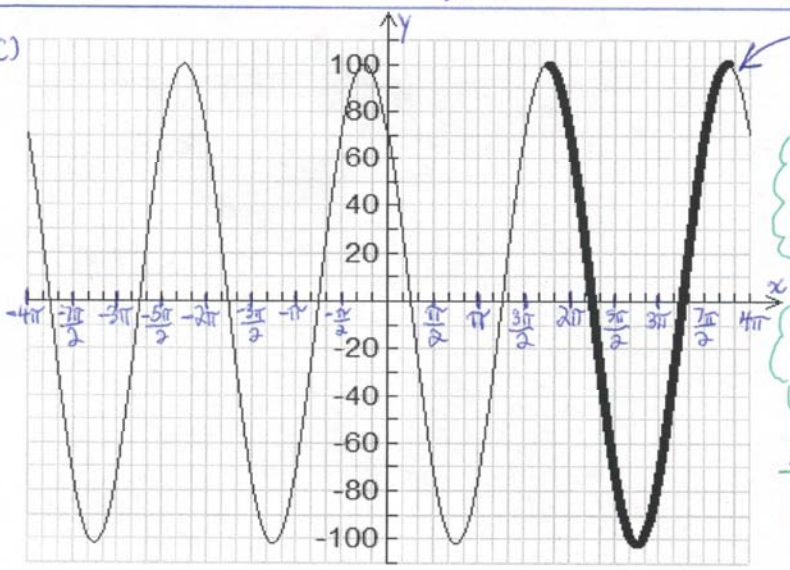
$A = \frac{4}{5},\ d = 10,\ p = -\frac{3\pi}{4}$

This one is done in two steps. First the stretches are applied, then the translations are done.

Suitable Scale for x-axis

Divide $7\pi$ by a number divisible by 4 (e.g. by 12). Made the grid too small → so I used 1 square = $\frac{\pi}{2}$

(c)



$y = 101\cos\left(x - \frac{7\pi}{4}\right) - \frac{9}{10}$

$(x,y) \to \left(x + \frac{7\pi}{4}, 101y - \frac{9}{10}\right)$

Since there is no horizontal stretch, the period of this function is the same as that of $y = \cos x$

$\therefore T = 2\pi$

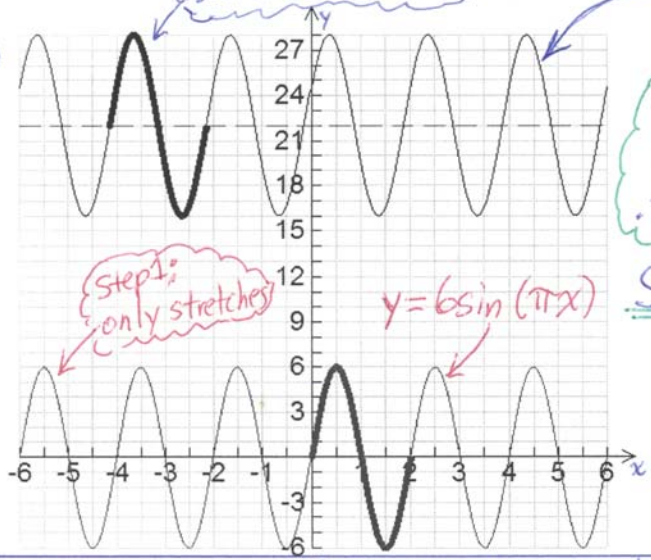
$A = 101,\ d = -\frac{9}{10},\ p = \frac{7\pi}{4}$

Suitable Scale for x-axis

Divide $2\pi$ by 12

$\frac{2\pi}{12} = \frac{\pi}{6} \to$ 1 square = $\frac{\pi}{6}$

(d)




$y = 6\sin(\pi x + 13) + 22 = 6\sin(\pi(x + \frac{13}{\pi})) + 22$

$(x, y) \to (\frac{1}{\pi}x - \frac{13}{\pi}, 6y + 22)$

Period of $y = \sin x$ is compressed by a factor of $\frac{1}{\pi}$

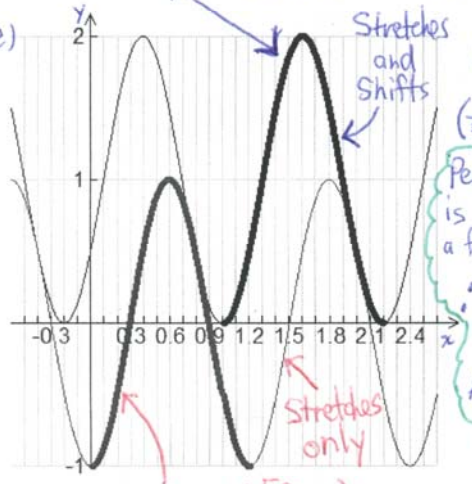
$\therefore T = 2\pi(\frac{1}{\pi}) = 2$, $A = 6$, $d = 22$, $p = -\frac{13}{\pi}$

**Suitable Scale for x-axis**

$T = 2 \to$ Divide 2 units into equal parts by a number divisible by 4. I used $\frac{2}{4} = \frac{1}{2}$

$\therefore$ 1 square $= \frac{1}{2}$

(e)




$y = -\cos(\frac{5\pi}{3}(x-1)) + 1$

$(x, y) \to (\frac{3}{5\pi}x + 1, -y + 1)$

Period of $y = \cos x$ is compressed by a factor of $\frac{3}{5\pi}$

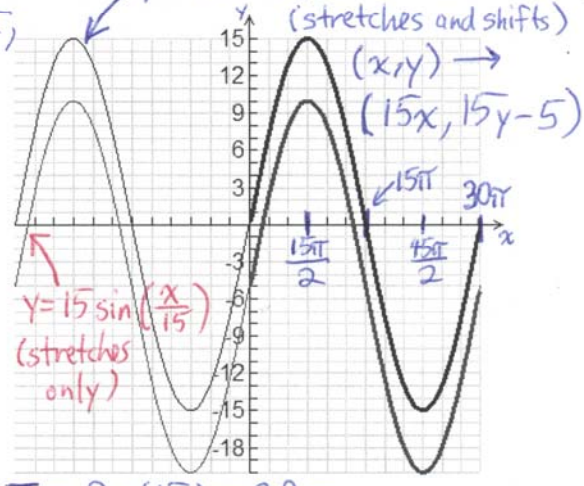
$\therefore T = 2\pi(\frac{3}{5\pi}) = \frac{6}{5}$

$A = 1$, $d = 1$, $p = 1$

$y = -\cos(\frac{5\pi}{3}x)$

Suitable Scale for x-axis: $\frac{(\frac{6}{5})}{12} = \frac{6}{5} \times \frac{1}{12} = \frac{1}{10} = 0.1$

(f)




$y = 15\sin(\frac{x}{15}) - 5 = 15\sin(\frac{1}{15}x)$

$(x, y) \to (15x, 15y - 5)$

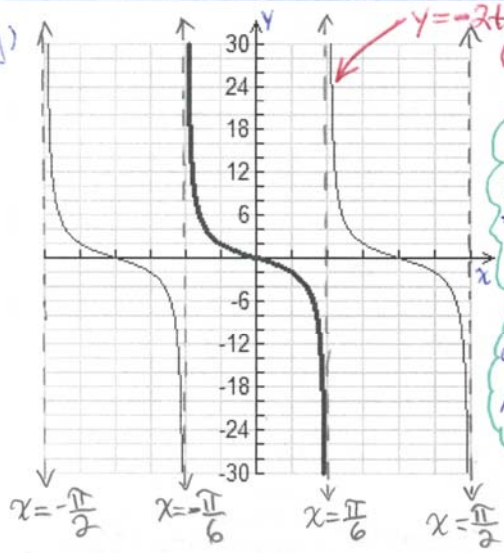
$A = 15$

$d = -5$

$T = 2\pi(15) = 30\pi$

Suitable Scale for x-axis: $\frac{30\pi}{12} = \frac{5\pi}{2} = 2.5\pi$

(g)



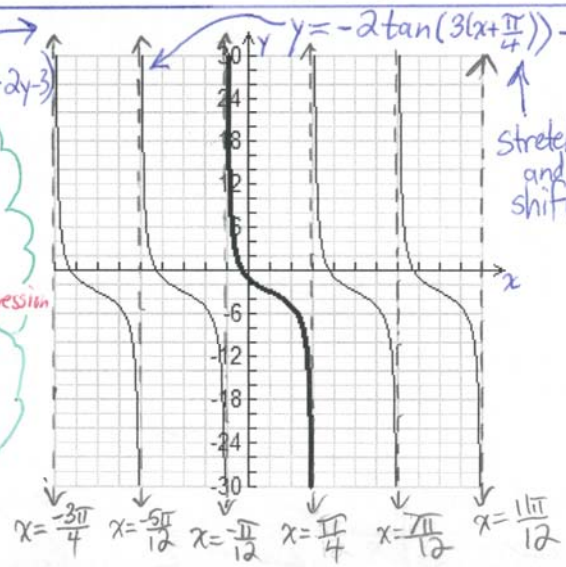

$(x, y) \to (\frac{1}{3}x - \frac{\pi}{4}, -2y - 3)$

Period of $y = \tan x$ is $\pi$. Therefore, $T = \pi(\frac{1}{3}) = \frac{\pi}{3}$ ← horizontal compression

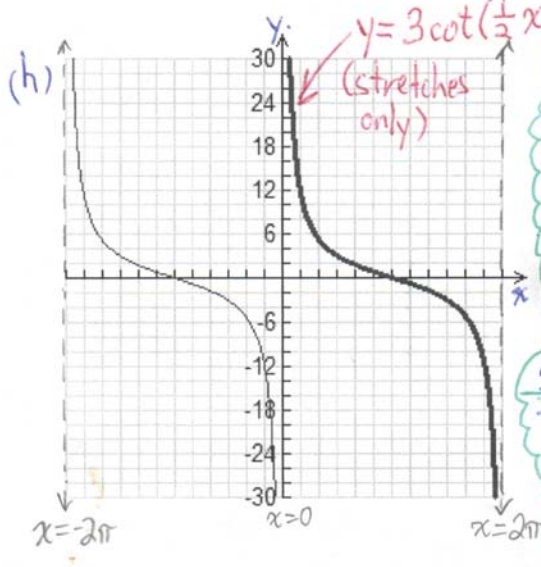
$d = -3$, $p = -\frac{\pi}{4}$

Amplitude is not defined

Scale for x-axis: $\frac{\pi}{6} \div 4 = \frac{\pi}{12}$



(h)




$(x,y) \to (2x+\frac{\pi}{3}, 3y+2)$

Period of $y=\cot x$ is stretched by a factor of 2

$\therefore T = \pi(2) = 2\pi$

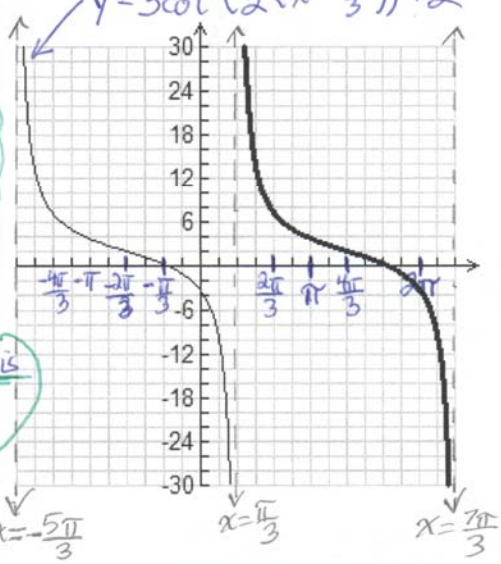
A is undefined

$d=2$, $p=\frac{\pi}{3}$

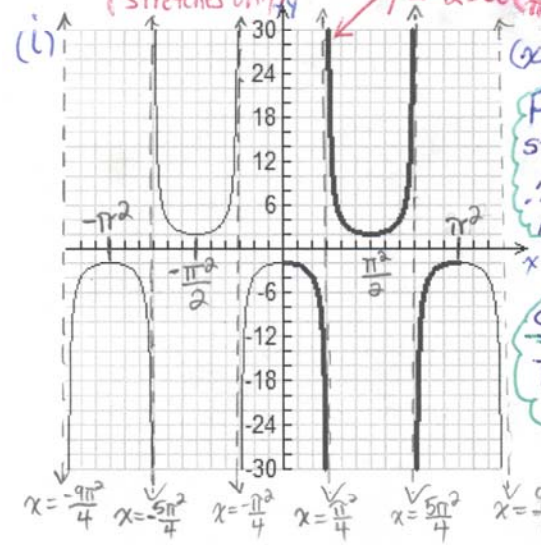
Suitable Scale for x-axis

$T=2\pi$, $\frac{2\pi}{12}=\frac{\pi}{6}$

Works well because phase shift is $\frac{\pi}{3}=2(\frac{\pi}{6})$




(i)




$(x,y) \to (\frac{\pi}{2}x - \frac{\pi}{6}, -2y+5)$

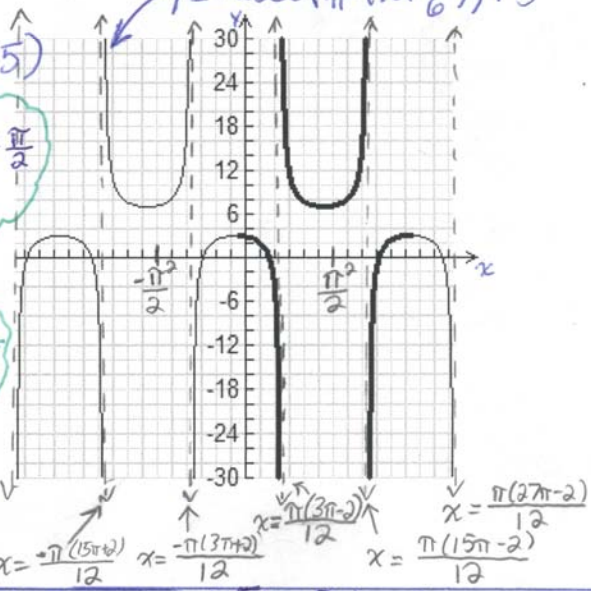
Period of $y=\sec x$ is stretched by a factor of $\frac{\pi^2}{2}$

$\therefore T = 2\pi(\frac{\pi}{2}) = \pi^2$

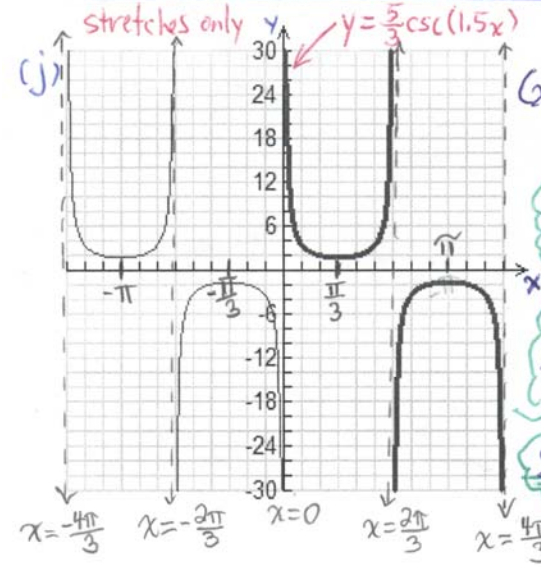
A is undefined, $d=5$, $p=-\frac{\pi}{6}$

Suitable Scale for x-axis

$T=\pi^2$, $\frac{\pi^2}{12}$ works well




(j)




$y = \frac{5}{3}\csc(1.5x + \frac{\pi}{4}) + \frac{3}{2} = \frac{5}{3}\csc(\frac{3}{2}(x+\frac{\pi}{6})) + \frac{3}{2}$

$(x,y) \to (\frac{2}{3}x - \frac{\pi}{6}, \frac{5}{3}y + \frac{3}{2})$

Period of $y=\csc x$ is compressed by a factor of $\frac{2}{3}$

$\therefore T = 2\pi(\frac{2}{3}) = \frac{4\pi}{3}$

A is undefined, $d=\frac{3}{2}$, $p=-\frac{\pi}{6}$

Suitable Scale for x-axis

$\frac{4\pi}{3} \div 12 = \frac{\pi}{9}$