Version 1

① Rational

VA $x=-4$ acts like $\frac{1}{x^2}$

$x=-4$

$$\frac{-3(x-1)^2}{(x+2)^2(x-4)}$$

Triple root @ $x=1$

HA $y=-3$

does $(0,-\frac{3}{4})$ work for a point?

$$-\frac{3}{4} = \frac{-3(+1)^2}{4(-4)} \quad \frac{-3}{18} \text{ or}$$

$$\frac{a(-1)^2}{4(-4)} = -\frac{3}{4}$$

$$\frac{a}{-16} = -\frac{3}{4} \qquad a = -\frac{3}{\cancel{4}}\cancel{(-16)}^{4} \quad 12$$

$$\boxed{f(x) = \frac{12(x-1)^2}{(x+2)^2(x-4)}}$$

② $(x+1)(x-1)^3(x-2)\,a = y$

$1(-1)^3(-2)\,a = -4$

$2a = -4$

$a = -2$

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

Prob. 3 looks like an exponential function, not a log function

shifted Down 1 $y = ab^x - 1$

for (0,1) $1 = ab^0 - 1$

$2 = a$

$y = 2b^x - 1$

(4,5) $5 = 2b^1 - 1$

$6 = 2b$

$3 = b$

$\boxed{y = 2(3)^x - 1}$

Bonus if you got it otherwise not counted.

(P4) midline $y = 2$

Per = 2 shifted Rm $\frac{1}{2}$

Cosine Am = 3

$$\boxed{y = 3\cos\left(\pi\left(x - \frac{1}{2}\right)\right) + 2}$$

or $3\sin(\pi x) + 2$

(5) $22^x = 10^{-4x}$

$x \log 22 = -4x$

$x = 0$

(7) $b^2 = 5^2 + 6^2 - 2(5)(6)\cos 50°$

$b^2 = 22.433$

$b = 4.736$

$\frac{\sin C}{6} = \frac{\sin 50}{4.736} = \frac{\sin A}{5}$

$\sin A = .8087$

$m\angle A = 53.974°$

$m\angle C = 76.026°$

(6) $\frac{\sec x - 1}{\tan x} = \frac{\tan x}{\sec x + 1}$

$\left(\frac{\frac{1}{\cos x} - 1}{\frac{\sin x}{\cos x}}\right)\left(\frac{\cos x}{\cos x}\right) = \frac{1 - \cos x}{\sin x}$

$\frac{1}{\sin x} - \frac{\cos x}{\sin x} =$

$\frac{1 - \cos x}{1} \cdot \frac{1}{\sin x}$

$\csc x - \cot x$

(7) $\frac{\sin x}{\cos x}$

$$\frac{\tan x}{\sec x + 1} \cdot \frac{\sec x - 1}{\sec x - 1} = \frac{\tan x(\sec x - 1)}{\sec^2 x - 1}$$

$$\frac{\tan x(\sec x - 1)}{\tan^2 x}$$

$\sin^2 + \cos^2 \theta = 1$

~~$\sin^2 x$~~

$\tan^2 x + 1 = \sec^2 x$

$$\frac{\sec x - 1}{\tan x}$$

(8) $\log_4(x+3) + \log_4(x-3) = 3$

$\log_4(x^2 - 9) = 3$

$x^2 - 9 = 64$

$x^2 = 73$

$x = \sqrt{73}$

(9) $f(x) = \sqrt{5+3x-2x^2}$

$5+3x-2x^2 \geq 0$

$2x^2-3x-5=0$

$(2x-5)(x+1)$

$\frac{5}{2}$ $\quad -1$ opens down so

$\left[-1, \frac{5}{2}\right]$

(10) $(0, 200)$ $(6, 36000)$

$36000 = 200b^6$

$b = 2.376$

$200(2.376)^{163}$

$$\begin{array}{r} 19 \\ 2375 \\ -1852 \\ \hline 163 \end{array}$$

3.664×10^{63} people

Version Y

(1) $\frac{-(x-1)^2}{(x+1)(x-4)^2}$

(2) $a(x+2)(x+1)^3(x-1) = y$

$1 = a(2)(1)(-1)$

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

(3) $y = ab^x + 1$ $y = -2b^x + 1$

$-1 = ab^0 + 1$ $-5 = -2b^1 + 1$

$-2 = a$ $-6 = -2b$

$3 = b$

$y = -2(3)^x + 1$

I messed up at this point

(4) Down 4 per $= \frac{2\pi}{3}$ $b = 3$ Amp $= 2$

$2\cos(3x) - 4$

(5) $\dfrac{(1+\sin x)(1-\sin x)}{\sin x\left(1-\frac{1}{\sin^2 x}\right)} \quad \dfrac{(1+\sin x)(1-\sin x)}{\frac{\sin^2 x-1}{\sin x}}$

$\sin\left(\frac{\sin^2-1}{\sin^2 x}\right.$

$$-\frac{(\sin x^2-1)}{\frac{\sin^2 x-1}{\sin x}} = \frac{-(\sin^2 x-1)}{1} \times \frac{\sin x}{\sin^2 x-1}$$

$$= -\sin x$$

$\dfrac{\cos^2 x}{\frac{\sin^2-1}{\sin x}}$ Does it work.

(6) $x = 0$

(7) $b^2 = 2^2 + 8^2 - 2(8)\cos 25$

$b^2 = 38.998$

$\boxed{b = 6.245}$

$\frac{\sin 25}{6.245} = \frac{\sin A}{2}$

7.78°

$m\angle C = 147.22^\circ$

The other angle could be 32.78°

(8)

$\log_4 (x+7)(x-7) = 1$

$x^2 - 49 = 4$

$x^2 = 53$ or ~~-53~~ $\sqrt{53}$

$x = \pm\sqrt{53}$

(9) $2x^2 - 3x - 5 = 0$

$(2x - 5)(x + 1)$

$\frac{5}{2}$ and -1

$(-\infty, -1] \cup [\frac{5}{2}, \infty)$

opens up.

(10) $72(1.019)^x = y$

$72(1.019)^x = 99$

$1.019^x = 1.375$

$x = \frac{\log 1.375}{\log(1.019)}$

$x = 16.919$ yrs