FINAL EXAM - TRIGONOMETRY - SUMMER 2021 - NEWTON

Instructions. You may work on this exam on your own time, using any resource you like (open notes, open book, open Internet). Please do not post the questions online. I will check if the questions have been posted, and solutions matching those online solutions will receive a zero. You still need to understand the material yourself, even if you are looking up some things. Show all your work and explain your solutions fully in order to get full credit. Copying from the book without understanding is not enough, and many internet solutions are outright wrong or missing information and explanations. Avoid using a calculator. You won't need one, since you don't have to simplify your numerical answers. **Leave your answers exact, do not convert to decimal** (as in, leave things with the square roots, fractions, e, π).

Your work on this exam should be your own. Working with other students can get you both a zero. Trust and believe in yourself over other students and the internet. When the question asks for an explanation of the work or your process, that means you should give an explanation in words, in addition to the mathematical work you showed to get to the answer. However, this isn't an English test, I don't care about whether it's a complete sentence, or whether you mispelled something, had bad grammar, etc. As long as you give some sort of correct explanation in words, it will be fine.

Good luck! Do your best! You'll do great.

(1) Graph the function $f(\theta) = 5\cos\left(\frac{1}{2}\theta - \frac{\pi}{8}\right) - 1$. Find the amplitude, period, horizontal and vertical shifts, and any asymptotes. Where is $f(\theta) = 0$?

(2) Let $\vec{u} = \langle 1, -1 \rangle$. Is $\vec{u}$ a unit vector? Find the angle between $\vec{u}$ and $\vec{v} = \langle 0, 5 \rangle$.

(3) Solve the equation $\sin(2\theta) + \cos^2(\theta) - 1 = 0$ for $0 \le \theta < 2\pi$. Justify each step of your work, and explain your overall strategy for solving the problem.

(4) Solve the triangle ABC with angle $A = 60°$, $a = 5$, and $b = 3$.

(5) A ladder is leaning against a building. The top of the ladder reaches 20 feet up the building, and the ladder is 30 feet long. Find the angle of elevation that the ladder makes with the ground, and find how far away the bottom of the ladder is from the bottom of the building.