# PRACTICE FINAL EXAM: PRECALCULUS, FALL 2020 - NEWTON

**Instructions.** You may work on this exam on your own time, using any resource you like (open notes, open book, open Internet). However, 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. Please 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, $e$, $\pi$).

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) Simplify the expression as much as possible:

$$\frac{i^3 + 1}{2 - i}$$

Convert your result to polar form.

(2) Eliminate the parameter in the set of parametric equations:

$$x = t + 1$$
$$y = 3 - t^2$$

Using your equation $y = f(x)$, find the domain and range. Solve $f(x) = 0$ for $x$.

(3) The temperature $T$ of an object in degrees Fahrenheit as a function of time is described by

$$T(t) = 20 + 10e^{2t}.$$

What is the temperature of the object at $t = 0$? How long will it take for the temperature of the object to reach 40 degrees Fahrenheit?

(4) Write an equation for a rational function that has: vertical asymptotes at $x = 1$ and $x = -1$, $x$-intercepts at $(2, 0)$ and $(3, 0)$ and a horizontal asymptote at $y = 2$.

(5) Let $\vec{u} = 1\hat{i} + 3\hat{j}$ and $\vec{v} = -2\hat{i} - 4\hat{j}$. Find $2\vec{u} + 3\vec{v}$, and find the magnitude of your result for $2\vec{u} + 3\vec{v}$.

(6) Verify the identity: $\cot(x) - \tan(x) = 2\cot(2x)$.