Math-19 Exam #3

Name: _____

This exam is closed book and notes. You may use a calculator; however, no cell phones or tablets are allowed. You are also allowed notes on both sides of a 3x5" note card. Show *all* work; there is **no** credit for guessed answers. All values should be exact unless you are specifically asked for an approximate value answer. In particular, you may leave answers to trig questions in terms of π.

1). Consider the following quadratic (parabola) function:

$$f(x) = -2x^2 - 12x - 13$$

a). Complete the square to put the function in standard form.

b). What is the vertex?

c). What are the x-intercepts (if any)?

d). What are the y-intercepts (if any)?

e). What is the axis of symmetry?

f). What is the domain?

g). What is the range?

h). Sketch the graph of the function. You must show and label the vertex, all intercepts, and the axis of symmetry for full credit; however, your sketch need not be to scale. Remember to state your answers in exact values (i.e., no decimal values allowed, but you may want to calculate them for relative positioning on your graph).

2). Consider the following polynomial function:

$$f(x) = x^6 - 8x^5 + 17x^4 + 6x^3 - 44x^2 + 8x + 32$$

a). Completely factor it into linear factors. It must be *clear* how you obtained candidate factors, determined that they are indeed factors, and how you reduced the problem for each found factor (i.e., long or synthetic division).

Problem 2a - Continued

b). What is the end behavior?

c). What are the x-intercepts (if any)?

d). What are the y-intercepts (if any)?

e). Construct a sign table or a list of behaviors due to multiplicity to explain what happens at each zero.

f). Sketch a graph of the function. You must show and label all zeros and intercepts and show the proper behavior and shape at each zero. Your sketch need not be to scale.

3). Consider the following rational function:

$$f(x) = \frac{x^2 + 3x - 4}{x^3 - x^2 - 6x}$$

a). What are the zeros (if any)?

b). What are the vertical asymptotes (if any)?

c). What are the horizontal asymptotes (if any)?

d). What is the end behavior for $x \to +\infty$? If it is asymptotic, be sure to indicate whether the asymptote is approached from below or above and why.

e). What is the end behavior for $x \to -\infty$? If it is asymptotic, be sure to indicate whether the asymptote is approached from below or above and why.

f). What are the y-intercepts (if any)?

g). Sketch a graph of the function. You must show and label all zeros, asymptotes, and intercepts, with the correct behavior at each. Your sketch need not be to scale.

4). Without using your calculator, determine the following *exact* values:

a). $\sin 210^\circ$

b). $\cos \frac{7\pi}{6}$

c). $\tan\left(-\frac{5\pi}{6}\right)$

5). Consider the following sinusoidal function:

$$f(x) = -3 \sin \frac{\pi}{2}(x - 1)$$

a). What is the amplitude?

b). What is the period?

c). What is b (the horizontal translation)?

d). What is ϕ (the phase angle)?

e). Is the phase angle leading or lagging?

f). Sketch the graph from $[0, b + \text{period}]$, i.e., one full period starting from the horizontal shift point, and then extended back to 0. You must clearly show the amplitude and the x values for each zero/min/max.

g). Looking at your sketch, what is an equivalent function in terms of $\cos$? (Hint: try to find where a cos graph overlays your graph)