

Queens College
Department of Mathematics

Final Examination

$2\frac{1}{2}$ Hours

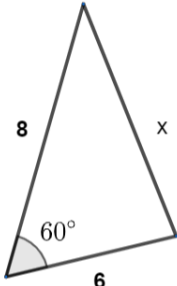
Math 122

Fall 2019

INSTRUCTIONS:

ANSWER ALL QUESTIONS

SHOW ALL WORK

- 1) Let $f(x) = \frac{x-2}{x+1}$ and $g(x) = \sqrt{3x+6}$.
- a) Find the domain of f and the domain of g .
 - b) Sketch the graph of $y = f(x)$. Label all intercepts and asymptotes and determine the range of f .
 - c) Find $f^{-1}(x)$ algebraically and find its domain.
 - d) Sketch the graph of $y = g(x)$ and use it to sketch the graph of $y = g^{-1}(x)$, the inverse function, on the same set of axes. Label all intercepts.
 - e) Find $(f \circ g)(x)$ and find its domain.
- 2) Let $p(x) = 2x^2 - 8x + 9$.
- a) Express $p(x)$ in standard form (vertex form).
 - b) Sketch the graph of $y = p(x)$. Label the vertex, and any and all intercept(s).
 - c) State the minimum value of $p(x)$.
- 3) Solve for x :
- a) $64^{3x+1} = 8^{4x-2}$
 - b) $\tan(\cos^{-1}(\frac{\sqrt{2}}{2})) = 3x + 2$
 - c) $\log_2(6x + 2) - \log_2(x - 3) = 4$
 - d) 

(Leave your answer in simplest radical form)

(continued on next page)

- 4) Let $P(x) = x^3 - 3x^2 - 10x$.
- Factor the polynomial and use the factored form to find all of the zeros of P .
 - Describe the end behavior of this polynomial function.
 - Use your calculator to find the coordinates of all of the local extrema of P . (Round your answers to two decimal places.)
 - Sketch the graph of this polynomial function. Label any and all intercepts.

5) Find the exact value of each of the following without using a calculator:

- $\sin(70^\circ)\cos(10^\circ) - \cos(70^\circ)\sin(10^\circ)$
- $\log_7(28) + \log_7(7) - 2\log_7(2)$
- $\cos^2\left(\frac{\pi}{12}\right) - \sin^2\left(\frac{\pi}{12}\right)$

6) Prove the following identity:

$$2 \sec x \sin x - \frac{2 \tan x}{\csc^2 x} = \sin 2x$$

7) Solve the equation $2 \sin^2(\theta) - \cos(\theta) = 1$ in the interval $[0, 2\pi)$.

8) If $\cos(A) = -\frac{12}{13}$, where A is in Quadrant II , and $\tan(B) = \frac{8}{15}$, where B is in Quadrant III , evaluate the following:

- $-\sin(2B)$
- $2 \sin(A)$
- $\cos(A + B)$

9) Sketch the graph of each of the following functions. In each case, determine its domain, label any and all intercepts, and identify any and all horizontal or vertical asymptotes.

- $f(x) = -e^{x+1} + 1$
- $g(x) = \frac{1}{3} \sin\left(x - \frac{\pi}{4}\right)$ (Show one complete period.)
- $h(x) = \ln(x + 4) - 2$

10) Virginia invested \$17,000 in an account that pays 8% interest per year, compounded quarterly.

- Find the amount in the account after 3 years. (Round your answer to two decimal places.)
- How long will it take for the investment to double? (Round your answer to two decimal places.)