

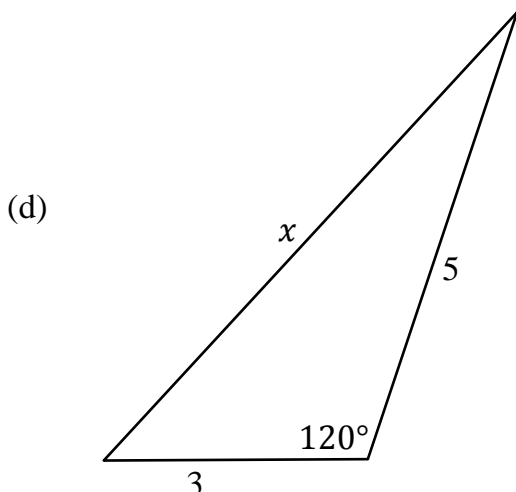
**QUEENS COLLEGE
DEPARTMENT OF MATHEMATICS
FINAL EXAMINATION
 $2\frac{1}{2}$ HOURS**

Mathematics 122

Spring 2017

INSTRUCTIONS: ANSWER ALL QUESTIONS. SHOW ALL WORK.

1. Let $f(x) = \frac{1}{x}$ and $g(x) = \sqrt{x+8}$.
- (a) Sketch and label the graph of $g(x)$. Indicate the coordinates of its x -intercept and its y -intercept and determine its domain.
 - (b) On the same set of axes, sketch and label the graph of $g^{-1}(x)$.
 - (c) Find an equation of $g^{-1}(x)$.
 - (d) Sketch the graph of $f(x)$ and determine its domain.
 - (e) Find $(f \circ g)(x)$ and determine its domain.
 - (f) Compute $g(1) - 3$.
 - (g) If $h \neq 0$, compute $\frac{f(a+h)-f(a)}{h}$. Simplify your answer.
2. Sketch the graph of each of the following equations, labelling the coordinates of any vertex, x -intercept(s), and y -intercept. Write an equation of any vertical and horizontal asymptotes where appropriate.
- (a) $y = -|x+2| - 1$
 - (b) $y = 4x - x^2$
 - (c) $y = 1 + 3^{-x}$
 - (d) $y = 4 \cos 2x$ on the interval $[0, 2\pi]$
 - (e) $y = \frac{1}{x-5} + 3$
3. Evaluate without the use of a calculator:
- (a) $\tan \frac{3\pi}{4}$
 - (b) $\sec \left(\sin^{-1} \left(\frac{\sqrt{3}}{2} \right) \right)$
 - (c) $\log_{20} 200 + \log_{20} 50 - \log_{20} 25$
 - (d) $\cos 50^\circ \cos 5^\circ + \sin 50^\circ \sin 5^\circ$
4. Solve for x :
- (a) $27^{3x-2} = 81^{x+1}$
 - (b) $\log_2(x+2) + \log_2(x-1) = 2$
 - (c) $2 \sin^2 x - \cos x = 1$ on the interval $[0, 2\pi]$



(continued on the back)

5. If $\cos A = -\frac{8}{17}$, where $\angle A$ is in quadrant II and $\tan B = \frac{3}{4}$, where $\angle B$ is in quadrant III, find:
- $\cot A$
 - $\sin(A - B)$
 - $\sin 2B$
6. Prove the following identities:
- $\tan x + \frac{\cos x}{1 + \sin x} = \sec x$
 - $\frac{1}{1 - \cos x} - \frac{1}{1 + \cos x} = 2 \cot x \csc x$
7. Sketch the graph of the polynomial function $f(x) = -x^4 - 2x^3 + 3x^2$. Make sure your graph shows all intercepts and exhibits the proper end behavior.
8. Let $f(x) = \frac{7x-2}{3x+1}$.
- Find $f^{-1}(x)$
 - Find $f^{-1}(2)$
9.
 - Solve for x : $12e^{2x} = 30$. Round your answer to the nearest thousandth.
 - How long will it take for an investment of \$ 2500 to double in value if the interest rate is $9\frac{1}{2}\%$ compounded continuously? Round your answer to the nearest thousandth.
10. An open box has a square base. If its surface area is 400 m^2 , express its volume as a function of x , the length of a side of the square base.

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