

DEPARTMENT OF MATHEMATICS  
BROOKLYN COLLEGE  
FINAL EXAMINATION—SPRING 2017  
MATHEMATICS 1026 (PRE-CALCULUS B)

Name: \_\_\_\_\_

**PART I: Answer all 8 questions. Each question is worth 8 points.  
Justify each answer and show all your work.**

1. Without the use of a calculator,
  - (a) convert  $10^\circ$  to radians.
  - (b) convert  $\frac{3\pi}{4}$  radians to degrees.
  
2. Evaluate and simplify the following expression:  
$$\sin\left(\frac{\pi}{3} + \frac{\pi}{6}\right) - \sec\frac{\pi}{3} + \cot\frac{\pi}{4}$$

(Do not use your calculator.)
  
3. A 6-foot ladder leans on a vertical wall. Suppose the height of the wall is  $\sqrt{27}$  feet.
  - (a) Find the angle the ladder makes with the wall.
  - (b) Find the distance from the bottom of the ladder to the wall.  
(Do not use your calculator.)
  
4. Let  $\theta$  be an obtuse angle and let  $\sin\theta = \frac{1}{2}$ . Find  $\sec\theta$ .  
(Do not use your calculator.)
  
5. In triangle  $ABC$  with right angle at  $C$ , side  $\overline{BC} = a = \sqrt{27}ft$  and side  $\overline{AC} = b = 3ft$ . Find angle  $A$ .  
(Do not use your calculator.)
  
6. Verify the following identity:  $\left(\frac{1 - \cot x}{\csc x}\right)^2 = 1 - \sin 2x$
  
7. Find the amplitude and period of the trigonometric function  $y = -2 \cos\left(\frac{1}{3}x\right)$  and sketch its graph in one complete period.
  
8. Find the term containing  $x^2$  in the binomial expansion of  $(\sqrt{x} + 2)^6$ .

**Please turn over!**

**PART II: Answer 4 out of 5 questions. Each question is worth 9 points. Justify each answer and show all your work.**

9. Let  $\theta$  be in the third quadrant and let  $\sin \theta = -\frac{2}{3}$ .

Without the use of a calculator,

(a) Find  $\cos 2\theta$ .

(b) Simplify and express  $\tan(\arcsin(-\frac{4}{5}))$   
in the form of rational numbers or radicals.

10. An equation of an ellipse  $4x^2 + 24x + 25y^2 - 50y - 39 = 0$  is given.  
Write the equation in standard form. Identify the center  $(h, k)$ , and  
 $a$  and  $b$  in the equation of the standard form.

11. Find the center, vertices, foci, and asymptotes of the hyperbola

$$\frac{(x-1)^2}{16} - \frac{(y-2)^2}{4} = 1$$

and sketch its graph.

12. (a) Solve for  $x$ :  $\sin^2 x + 2\cos x = -2$  for  $0 \leq x < 2\pi$

(b) If  $A$  is in the first quadrant with  $\cos A = \frac{\sqrt{2}}{2}$ , and  $B$  is in the  
third quadrant with  $\cos B = -\frac{1}{3}$ , find  $\tan(A + B)$ .

13. (a) Use the Laws of Sines and or Cosines to solve the triangle  $ABC$ .  
Given  $\angle B = 30^\circ$ , side  $a = 1$  cm, and side  $c = \sqrt{3}$  cm, find side  $b$ ,  
 $\angle A$  and  $\angle C$ .

(b) With the use of an appropriate formula, evaluate the following  
expression without the use of a calculator:

$$\cos 260^\circ \cos 70^\circ - \sin 260^\circ \sin 70^\circ$$

**End of Examination**