A. Sign and date your scantron on the back at the bottom.

B. In pencil, write and encode in the spaces indicated on your scantron:
   1) Name (last name, first initial, middle initial)
   2) UF ID Number
   3) Section Number

C. Under "special codes" on your scantron, code in the test ID number 4, 4.
   1 2 3 • 5 6 7 8 9 0
   1 2 3 • 5 6 7 8 9 0

D. At the top right of your scantron, for "Test Form Code", encode D.
   A B C • E

E. 1) There are eighteen 4-point multiple-choice questions and two 4-point free response questions, for a total of 80 points.
   2) The time allowed is 90 minutes.
   3) You may write on the test.
   4) Raise your hand if you need more scratch paper or if you have a problem with your test. DO NOT LEAVE YOUR SEAT UNLESS YOU ARE FINISHED WITH THE TEST.

F. KEEP YOUR SCANTRON COVERED AT ALL TIMES.

G. When you are finished:
   1) Before turning in your test, check for transcribing errors. Any mistakes you leave in are there to stay.
   2) Take your test, scratch paper, and scantron to your TA. Be prepared to show your UF ID card.
   3) Answers will be posted in E-Learning after the exam.

H. By taking this exam, you agree to the following Honor Pledge:

   "I will neither give nor receive any unauthorized aid for this exam."
MAC 1147 — Spring 2018 — EXAM 4D

Questions 1–18 are worth 4 points each.

1. Given \( \cos \beta = \frac{4}{5} \) and \( \csc \beta < 0 \), find \( \sin \beta + \cot \beta \).

   A. 1  B. \( \frac{13}{20} \)  C. \( \frac{-31}{20} \)  D. \( \frac{13}{15} \)  E. \( \frac{-29}{15} \)

2. Given \( f(x) = 3 \cot \left( \frac{x}{4} + \frac{\pi}{2} \right) \) which are true?

   P. The function has no \( x \)-intercepts.

   Q. The function is decreasing over its domain.

   R. The period of the function is \( 4\pi \).

   A. R only  B. Q only  C. They are all false.
   D. P only  E. Q and R only
3. Find the phase shift of \( f(x) = 2 \sin \left( \frac{x}{2} - 3\pi \right) \).

A. \(-6\pi\)  
B. 6  
C. 4\(\pi\)  
D. 1  
E. 6\(\pi\)

4. Evaluate.

\( \cos^{-1} \left( -\frac{1}{2} \right) \)

A. \(\frac{2\pi}{3}, \frac{4\pi}{3}\) only  
B. 2 only  
C. \(-\frac{2\pi}{3}\) only  
D. \(-2\) only  
E. \(\frac{2\pi}{3}\) only
5. Use the substitution \( x = \frac{4}{3} \tan \theta, \ 0 < \theta < \frac{\pi}{2} \) to rewrite the equation \( \sqrt{9x^2 + 16} = 28 \) and then find \( \tan \theta \).

\[
\begin{array}{ccccc}
A. \, 2\sqrt{3} & B. \, 4\sqrt{6} & C. \, 2\sqrt{6} & D. \, 4\sqrt{3} & E. \, \sqrt{3}
\end{array}
\]

6. Evaluate.

\( \sin(\sin^{-1} \pi) \)

\[
\begin{array}{cc}
A. \, \text{Does not exist.} & B. \, \pi & C. \, 1 \\
D. \, 3\pi & E. \, 0
\end{array}
\]
7. Which of the following are vertical asymptotes of the function \( f(x) = 3 \tan \left( 3x - \frac{\pi}{2} \right) \)?

- P. \( x = -\pi \)
- Q. \( x = \frac{\pi}{3} \)
- R. \( x = \frac{\pi}{6} \)

A. P, Q, and R only
B. None are vertical asymptotes.
C. P only
D. R only
E. P and Q only

8. Which of the following equations has the same graph as \( f(x) \)? Hint: Write an algebraic expression that is equivalent to the given expression.

\[ f(x) = \sin(\arctan 4x) \]

A. \( g(x) = \frac{4x}{\sqrt{1 + 4x^2}} \)
B. \( g(x) = \frac{4x}{\sqrt{1 - 16x^2}} \)
C. \( g(x) = \frac{x}{\sqrt{1 + x^2}} \)
D. \( g(x) = \frac{4x}{\sqrt{1 - x^2}} \)
E. \( g(x) = \frac{4x}{\sqrt{1 + 16x^2}} \)
9. Which statements are true?

P. \( \tan \alpha = \tan(\alpha - 6\pi) \).

Q. The function \( g(t) = \sin t \cdot \cos t \) is an odd function.

R. \( \cos \left( -\frac{7\pi}{2} \right) = \cos \left( \pi + \frac{\pi}{2} \right) \).

A. R only       B. P and R only       C. Q only
D. P and Q only E. P, Q, and R

10. Given the function \( y = \frac{1}{2} \sin(\pi x + \pi) \), which are true?

P. The amplitude is \( \frac{1}{2} \).

Q. The period is 2.

R. \((-1, 0)\) is a point on the graph.

A. P and R only       B. P, Q, and R       C. R only
D. Q only             E. P only
11. Given $\sin(-t) = \frac{4}{7}$, find $\csc t$.

\[
\begin{array}{cccc}
\text{A. } \frac{7}{3} & \text{B. } \frac{\sqrt{33}}{7} & \text{C. } -\frac{7}{3} & \text{D. } -\frac{7}{4} & \text{E. } \frac{7}{4}
\end{array}
\]

12. Given the right triangle, what is the value of $\sin \theta \cdot \cot \theta$?  
_The figure is not drawn to scale._

\[
\begin{array}{cccc}
\text{A. } \frac{2\sqrt{5}}{5} & \text{B. } 2 & \text{C. } 2\sqrt{5} & \text{D. } \frac{\sqrt{5}}{5} & \text{E. } \frac{\sqrt{5}}{10}
\end{array}
\]
13. Which are identities?

P. $\sec \theta \cos \theta = -1$

Q. $\frac{\cos \theta \cot \theta}{1 - \sin \theta} - 1 = \csc \theta$

R. $\frac{1}{\tan x} + \frac{1}{\cot x} = \tan x + \cot x$

A. Q and R only  
B. P only  
C. P and Q only  
D. R only  
E. Q only

14. Which are identities?

P. $\sin \theta \tan \theta \sec \theta = \cot^2 \theta$

Q. $\frac{1}{\sin^2 \theta} + \frac{1}{\cos^2 \theta} = \tan^2 \theta$

R. $\frac{1 + \sec \alpha}{\sin \alpha + \tan \alpha} = \csc \alpha$

A. P and R only  
B. R only  
C. P only  
D. Q only  
E. P, Q and R only
15. A ship leaves port at noon and has a bearing of S 57° W traveling at 10 nautical miles per hour. How many nautical miles west will the ship have traveled by 6:00 p.m.?

A. $60(\tan 33°)$  B. $60(\tan 57°)$  C. $60(\sin 33°)$
D. $60(\sin 57°)$  E. $60(\cos 57°)$

16. Given $\cot x = \frac{7}{4}$ and $\sin x < 0$, which of the following is true?

A. $\cos x = \frac{7\sqrt{65}}{65}$
B. $\cot \left(\frac{\pi}{2} - x\right) = -\frac{4}{7}$
C. $\tan \left(\frac{\pi}{2} - x\right) = \frac{7}{4}$
D. $\sin \left(\frac{\pi}{2} - x\right) = -\frac{4\sqrt{65}}{65}$
E. $\sec x = \frac{\sqrt{65}}{4}$
17. Given angle $\theta$ is in standard position with $\cos \theta = -\frac{12}{13}$ and $\sin \theta < 0$, find $\csc \theta$.

A. $-\frac{13}{5}$  
B. $-\frac{13}{12}$  
C. $\frac{5}{13}$  
D. $-\frac{5}{13}$  
E. $-\frac{12}{13}$

18. During takeoff, an airplane's angle of ascent is $30^\circ$ and its speed is 200 feet per second. Find the plane's altitude in feet after 1 minute.

A. 3000 feet  
B. 6000 feet  
C. 200 feet  
D. 12,000 feet  
E. 8000 feet
19. Given: \( f(x) = \frac{1}{2} \sin(4x + \pi) \).

(a) List five key points.

\[
\begin{array}{c|c|c|c|c|c}
 x & & & & & \\
y & & & & & \\
\end{array}
\]

(b) Graph the function and label each axis. Graph at least one full period.
20. Given: \( f(x) = \cot \frac{\pi}{12}x \).

(a) Graph two full periods of the function and label each axis.

(b) List the equations of three consecutive asymptotes.

\[ \text{and} \] \[ \text{and} \] \[ \text{and} \]

(c) List the coordinates of two consecutive \( x \)-intercepts.

\[ \text{and} \] \[ \text{and} \]

Make sure your UF ID and answers are bubbled correctly. Turn in your scantron and your free response to your TA. You keep the test.