Show all your work in the space provided under each question. Please write neatly and present your answers in an organized way. You may use your notecard, but calculators are not allowed.

(12 pts) 1. Verify the identity: \( \frac{\cos \beta}{1 - \sin \beta} = \sec \beta + \tan \beta \).
2. Convert to radians: $162^\circ$.

3. Convert to degrees: $\frac{3\pi}{5}$ radians.

4. A circular pizza has radius 6 inches. A piece in the shape of a sector of the circle is cut out so that the angle at the point of the sector (at the center of the pizza) is $1$ radian. What is the area of this piece of pizza?
(8pts) 5. Find the exact value of $\sin^{-1}\left(\frac{1}{2}\right)$.

(8pts) 6. Find $\sin^{-1}\left(\sin\frac{7\pi}{6}\right)$. 

(8pts) 7. Find the exact value of \( \cos \left( \frac{5\pi}{12} \right) \). Leave your answer as an expression involving integers and square roots of integers.

(8pts) 8. Find the exact value of \( \tan \left( \frac{\pi}{12} \right) \). Leave your answer as an expression involving integers and square roots of integers.
(8 pts) 9. Find the equation of the parabola with directrix $y = 4$ and focus $(2,0)$. Then sketch its graph.

(8 pts) 10. An observer in a lighthouse at the ocean’s edge is 200 feet above the surface of the water. The observer sees a ship and finds the angle of depression of his line of sight to the ship is $1^\circ$. How far (in feet) is the ship from the base of the lighthouse?
10. Find the amplitude, period and phase shift of the function $y = 2 \sin \left(2x - \frac{\pi}{2}\right)$ then sketch its graph. Label the $x$-intercept and the $y$-intercepts for at least 2 periods of the graph.

11. Sketch the graph of the polar equation $r = 2(1 + \sin \theta)$.
12. Suppose a triangle has sides of length $a$, $b$, $c$ and angles $\alpha$, $\beta$, $\gamma$ such that the side of length $a$ is opposite $\alpha$, the side of length $b$ is opposite $\beta$ and the side of length $c$ is opposite $\gamma$. Suppose $\alpha = 15^\circ$, $\beta = 30^\circ$ and $b = 4$. Find $\gamma$, $a$ and $c$.

13. Find the absolute value: $|5 - 2i|$.
(8pts) 14. Write $\sqrt{6} - \sqrt{2}i$ in trigonometric form, that is, in the form $r(\cos \theta + i \sin \theta)$ where $r > 0$, $0 \leq \theta < 2\pi$.

(8pts) 15. Find all solutions of the equation $x^5 - 1 = 0$. 
16. Find the equation of the ellipse with foci at $(2,0), (-2,0)$ and vertices at $(0,\sqrt{12}), (0,-\sqrt{12})$.

17. Find the eccentricity and classify the conic. Sketch the graph and label the vertices:

$$r = \frac{1}{1 - \sin \theta}.$$
18. Find all solutions to $\sin x - \sin 3x = 0$.

19. Sketch the graph of the hyperbola $\frac{x^2}{16} - \frac{y^2}{9} = 1$. Label the vertices, foci and asymptotes.
(12pts) 20. A ship leaves port at 1:00 p.m. and travels S 35° E at the rate of 24 mi/hr. Another ship leaves the same port at 1:30 p.m. and travels S 20° W at 18 mi/hr. Approximately how far apart are the ships at 3:00 p.m.?
(20 pts) 21. Find the exact value of the trigonometric functions, that is, leave your answer as an expression involving integers or square roots of integers. Do not find decimal approximations. Show your work; indicate with diagrams how you found your answer. Each part is worth 4 pts.

a) \( \sin 0 \)

b) \( \cos \pi \)

c) \( \cos \frac{7\pi}{6} \)

d) \( \tan \frac{5\pi}{3} \)

e) \( \sin \left(-\frac{\pi}{6}\right) \)