Q3 Cumulative

1. Eliminate the parameter t: $x = t^3 - 2$ and $2y = 1 - t^2$
   A. $y = 1 - \sqrt[3]{(x+2)^2}$
2. Eliminate the parameter t: $x = 4\sin t + 1$ and $y = 3\cos t - 2$
   A. $\dfrac{(x-1)^2}{16} + \dfrac{(x+1)^2}{9} = 1$
3. Convert the polar coordinate $(6, -2\pi/3)$ to rectangular coordinates
   A. $(3, -3\sqrt{3})$
4. Convert this equation to polar coordinates: $x^2 - y^2 = 16$
   A. $r = \dfrac{4}{\cos^2\theta - \sin^2\theta}$
5. Convert this equation to rectangular coordinates: $r = 3\sec\theta$
   A. $x = 3$
6. Which of the following is the graph of $r = \cos(2\theta)$
   A. A 4 leaf rose with x-intercept $(2, 0)$

7. A baseball pitcher throws a baseball with an initial speed of 138 feet per second at an angle of 20° to the horizontal. The ball leaves the pitcher's hand at a height of 4 feet above the ground. Write the equations of motion.
   A. $v_x(t) = 138\cos(t)$, $v_y(t) = 138\sin(t) - 32t$, $s_x(t) = 138t\cos(t)$, $s_y(t) = 138t\sin(t) - 16t^2 + 4$

8. Let $u = \langle -3, 5\rangle$ and $\vec{v} = \langle 1, 4\rangle$ and $\vec{w} = \langle 6, -3\rangle$ find $\vec{u} + 2\vec{v} - \vec{w}$

9. Given $\vec{u} = \langle 3\sqrt{3}, -5\rangle$, find $\|\vec{u}\|$

10. Given $\vec{u} = \langle -10, 9\rangle$, find a unit vector in the direction of $\vec{u}$

11. Which vector is perpendicular to $\langle \frac{2}{3}, -\frac{17}{2} \rangle$

12. Which vector is parallel to $\langle \frac{2}{3}, -\frac{17}{2} \rangle$

13. What is the angle between $\langle 5, 1 \rangle$ and $\langle 2, -3 \rangle$

14. If vector $\vec{x}$ has magnitude 9 and makes an angle of $3\pi/4$ with the positive x axis, find the components of x and write as $a\hat{i} + b\hat{j}$.

15. Write the complex number $-3 + 9i$ in polar form.

16. Divide $10 - 9i$ by $2 - 4i$, and express your answer in the form $a + bi$.

17. Simplify the product $\sqrt{7}e^{-i\pi/3} \cdot 3e^{i\pi/5}$.

18. Solve the equation $z^2 - 2z + 5 = 0$ for z and express your answers in rectangular form.

19. If $z = 2 + i$ is one root of a quadratic equation $x^2 + bx + c$ with real coefficients, what is bc?

20. If $z^4 = 16e^{2\pi i/5}$, find all values of z in polar form.

21. Factor $z^2 + 9$ into a product of two binomials.

22. (Bonus): By multiplying two complex numbers, prove the addition identities for sin and cos.