1. **B** To convert the polar coordinates \((-2, \frac{\pi}{3})\) to rectangular coordinates, you might find these equations useful: \(x = r \cos \theta\) and \(y = r \sin \theta\). By direct substitution you can find they equal \((-1, -\sqrt{3})\).

2. **C** To identify the graph with equation: \(x^2 - 2xy + y^2 = 4\), you can factor the left side of the equation to get: \((x - y)^2 = 4\); \(x - y = 2\) or \(x - y = -2\). *(2 parallel lines)*

3. **A** To find a possible equation for the graph, it would be helpful to locate the center of the ellipse (and know that you are looking at an ellipse! 😎) as well as the major and minor axes lengths. The center is at \((-1, 2)\) and the major radius is 3 units along the x-axis while the minor radius is 2 units along the y-axis. \(\frac{(x+1)^2}{3^2} + \frac{(y-2)^2}{2^2} = 1\)

4. **E** To find the eccentricity for the graph in Question 3, we must solve for \(c\) using the equation: \(c^2 = a^2 - b^2\); \(c^2 = 9 - 4 = 5\); \(c = \sqrt{5}\); \(e = \frac{c}{a} = \frac{\sqrt{5}}{3}\)

5. **C** To find the area of the graph in Question 3, we need the formula for the area of an ellipse: \(A = ab\pi = (3)(2\pi) = 6\pi\)

6. **C** To find a set of parametric equations for the graph, we must find the change in \(x\) and the change in \(y\) as the time changes. The initial value of \(x\) is -2 and the initial value of \(y\) is 4. The rate at which the \(x\) changes is 3 and the \(y\) changes at a rate of -1.
   
   \[x = -2 + 3t \quad y = 4 - t \quad t \mid 0 \leq t \leq 3\]

7. **B** To find the maximum height in meters of a baseball tossed at an initial angle of 60 degrees and speed of 5 meters per second: \(\frac{25(sin60)^2}{2(10)} = \frac{15}{16}\)

8. **C** To find the horizontal range of the baseball from Question 7, \(\frac{5^2(sin120)}{10} = \frac{5\sqrt{3}}{4}\).

9. **B** To find the value of \(x\) if \(\theta = \frac{\pi}{3}\) in Triangle ABC, we could use special right triangles or trigonometry to calculate that if opposite the 60 degree angle in a 30-60-90 (x- xrt3 - 2x) triangle is 12, opposite the 30 degree angle must be \(4\sqrt{3}\)
10. \( \tan 40^\circ \approx 0.84 = \frac{x+y}{87} \) and \( \tan 25^\circ \approx 0.47 = \frac{y}{87} \); \( y = 40.89 \) and \( x = 32.19 \)

\**y is the leftover part of the tower on the diagram.**

11. B To find the height of the tower from Question 10: \( 40.89 + 32.19 = 73.08 \) feet.

12. E To simplify: \( \frac{\cot(x) \sin(x)}{\cos(x)} = \frac{\cos(x) \sin(x)}{\cos x} = 1 \)

13. C To find the area of the polar graph of \( r = 4 \sin \theta \), it is helpful to know that the graph is a circle with diameter of 4 along the y-axis from the pole. Using the area of a circle, you can find the area to be: \( 4\pi \)

14. D You already know what the graph looks like from Question 13, so if you take half of the diameter, you know the center is 2 units from the pole in the positive y direction. Find the center of the graph in polar coordinates for Question 13. \( (2, \frac{\pi}{2}) \)

15. C You already know what the graph looks like from Question 13, so to find the circumference (perimeter) of the circle, you can just multiply the diameter by \( \pi \).

16. B To solve \( \tan \left( \frac{\theta}{2} \right) = \sqrt{3} \) on the interval \( 0 < \theta < 4\pi \), We can look for places on the unit circle that have a tangent of \( \sqrt{3} \). Those values are: \( \frac{\pi}{3}, \frac{4\pi}{3}, \frac{7\pi}{3}, ... \) These values are for half of theta. So the values for theta are: \( \frac{2\pi}{3}, \frac{8\pi}{3}, \frac{14\pi}{3}, ... \) The sum of all values of \( \theta \) in the given interval are \( \frac{10\pi}{3} \)

17. E To solve for \( x \) on \([-2\pi, 0)\) for \( 2 \sin^2 x - 3 \sin x - 2 = 0; (2\sin x + 1)(\sin x - 2) = 0; \sin x = -\frac{1}{2} \) or \( \sin x = 2 \) (extraneous); \( x = -\frac{\pi}{6}, -\frac{5\pi}{6} \).

18. C \[
\begin{vmatrix}
-3 & 0 & 1 \\
-2 & 10 & 4 \\
6 & -1 & 0
\end{vmatrix} = -3(0 - (-4)) - 0(0 - 24) + 1(2 - 60) = -12 - 58 = -70.
\]
19. 

\[
\begin{vmatrix}
  e^0 & 0.25 & \tan 0 \\
  \sqrt[3]{-8} & \sec \pi & \log_2 128 \\
  3! & \cot \frac{\pi}{2} & \left(\frac{1}{2}\right)^{-3}
\end{vmatrix}
= \begin{vmatrix}
  1 & 0 & 0 \\
  -2 & -1 & 7 \\
  6 & 0 & 8
\end{vmatrix}
= 1(-8 - 0) = -8.
\]

20. A
To solve the equation: \(4 \log_9 x + 8 = 12\); \(4 \log_9 x = 4\); \(\log_9 x = 1\); \(x = 9\)

21. C

English = W

Physics = Y

\[
\begin{array}{c}
6 \\
8 \\
21
\end{array}
\]

\(21/45 = 7/15\)

22. B
To find \(P(\text{English}|\text{Physics})\) for Question 21, you are looking for how many students take English given that they are a Physics students, so out of the 29 students in Physics, 8 of them are also in English, \(8/29\).

23. A
MU University wants to make student ID badges with a code consisting of 2 different letters followed by 4 different digits: \((7)(8)(9)(10)(25)(26)\) - Because you cannot reuse letters or numbers, the value goes down by 1 each time you select one.

24. D
What is the probability that an ID code from Question 23 would have two vowels?

The numbers could be anything, so we are only worried about the letters. There are a total of \((26)(25)\) ways of selecting the letters. But only \((5)(4)\) of them are with vowels only. If you simplify \(20/(26 \times 25) = 2/65\).
25. **B** Vector \( c \) is perpendicular to the two given vectors \( a \) and \( b \). \( c \) is the cross product of the two given vectors (definition).

![Diagram of vectors a, b, and c]

26. **E** To find the triple scalar product of the vectors: \(< 2,3,4 >, \quad <-1,1,-1 >\) and \(< -1,-3,-5 >\).

\[
\begin{vmatrix}
2 & 3 & 4 \\
-1 & 1 & -1 \\
-1 & -3 & -5 \\
\end{vmatrix} = 2(-5 - 3) - 3(5 - 1) + 4(3 - (-1)) = -16 - 12 + 16 = -12
\]

27. **A** To find the equation of the directrix of the graph of the equation in polar: \( r = \frac{12}{4 - 4 \cos \theta} \), we can tell it will be a \( x = \) equation because of the cosine in the graph equation. I can find the eccentricity by dividing the numerator and denominator by 4, and see that \( e = 1 \) (parabola). That makes the distance \( k = 3 \). That gives us the number value for the directrix. Because there is a negative sign on the eccentricity, I know the equation of the directrix will also be negative. In rectangular coordinates, it would simply by \( x = -3 \). But you were asked to put the equation in polar, so \( r = -3 \sec \theta \).

28. **C** To find the limit from the right (that is what the plus sign in the exponent spot means), you simply need to substitute \(-3\) into the greater than equation: \( f(x) = \begin{cases} 
 x - 2 & x < -3 \\
 x^2 & x \geq -3 
\end{cases} \)

\[
\lim_{x \to -3^+} f(x) = 9
\]

29. **B** \( \frac{5\pi/12}{2\pi} = \frac{x}{8\pi}; \quad x = 5\pi/3 \)

30. **B** The number of permutations of the letters in the word BASEBALL = \( \frac{8!}{2!2!2!} = 5040 \)