1. **B** To convert the polar coordinates $(-2, \frac{\pi}{3})$ to rectangular coordinates, you might find these equations useful: $= rcos\theta \quad and\ y = rsin\theta$. 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: $A = ab\pi = (3)(2)\pi = 6\pi$

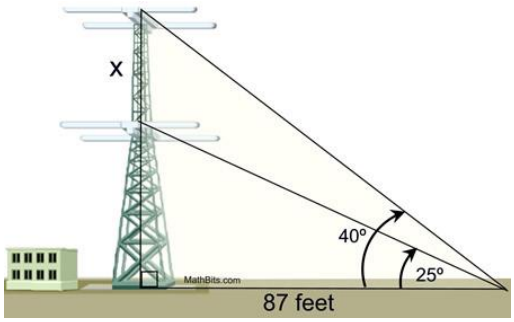
6. **C** To find a set of parametric equations for the graph, we must find the change in x and the change in y as the time changes. The initial value of x is -2 and the initial value of y is 4. The rate at which the x changes is 3 and the y changes at a rate of -1.
$$x = -2 + 3t \quad y = 4 - t \quad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

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: $\frac{25(sin60)^2}{2(10)} = 15/16$

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. **D**



$tan40° \approx 0.84 = \frac{x+y}{87}$ and $tan25° \approx 0.47 = \frac{y}{87}$; $y = 40.89$ 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.

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

13. **C** To find the area of the polar graph of $r = 4sin\theta$, 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: 4π

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. $(2, \pi/2)$

15. **C** You already know what the graph looks like from Question 13, so to find he 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 root3. Those values are: $\frac{\pi}{3}, \frac{4\pi}{3}, \frac{7\pi}{3}, \ldots$ These values are for half of theta. So the values for theta are: $2\frac{\pi}{3}, \frac{8\pi}{3}, \frac{14\pi}{3}, \ldots$The sum of all values of θ in the given interval are $\frac{10\pi}{3}$

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

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

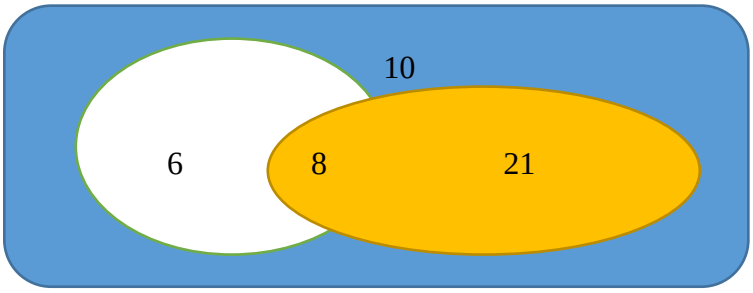
19. C $\begin{vmatrix} e^0 & \frac{0}{4} & \tan 0 \\ \sqrt[3]{-8} & \sec\pi & log_2 128 \\ 3! & cot\frac{\pi}{2} & \left(\frac{1}{2}\right)^{-3} \end{vmatrix} = \begin{vmatrix} 1 & 0 & 0 \\ -2 & -1 & 7 \\ 6 & 0 & 8 \end{vmatrix} = 1(-8-0) = -8.$

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

21. C

English = W

Physics = Y



21/45 = 7/15

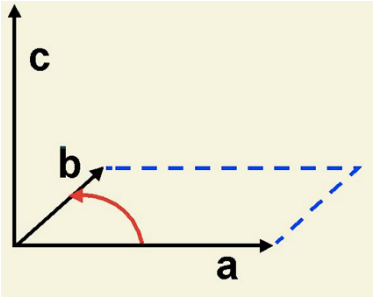
22. B To find $P(English|Physics)$ for Question 21, you are looking for how many students take English given that they are a Physics students, so out of the 29 students in Physics, 8 of them are also in English, 8/29.

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/(26x25) = 2/65.

25. **B** Vector c is perpendicular to the two given vectors $\boldsymbol{a}$ and $\boldsymbol{b}$. c is the cross product of the two given vectors (definition).



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

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

27. **A** To find the equation of the directrix of the graph of the equation in polar: $r = \frac{12}{4-4cos\theta}$, 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 $r = -3sec\theta$.

28. **C** To find the limit from the right (that is what the plu 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** $\frac{5\pi/_{12}}{2\pi} = \frac{x}{8\pi}; x = 5\pi/3$

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