Solutions, Midterm 1, 24 Feb 2017.

1. FALSE $\begin{pmatrix}0\\0\end{pmatrix} = 0\begin{pmatrix}1\\1\end{pmatrix}$, but $\begin{pmatrix}1\\1\end{pmatrix} \neq k\begin{pmatrix}0\\0\end{pmatrix}$ for all k

2. $\begin{pmatrix}2\\-3\end{pmatrix} - \begin{pmatrix}5\\4\end{pmatrix} = \begin{pmatrix}-3\\-7\end{pmatrix}$ $\quad x = 5-3t,\ y = 4-7t$
(other solutions are possible)

3. $\det\begin{bmatrix}3 & -2\\ x & 4\end{bmatrix} = 3\cdot 4 - x(-2) > 0 \Rightarrow 2x > -12 \Rightarrow x > -6$

4. $\begin{bmatrix}0 & 1\\ -1 & 0\end{bmatrix}\begin{bmatrix}1 & 0\\ 0 & -1\end{bmatrix}\begin{pmatrix}x\\y\end{pmatrix} + \begin{pmatrix}7\\0\end{pmatrix} = \begin{bmatrix}0 & -1\\ -1 & 0\end{bmatrix}\begin{pmatrix}x\\y\end{pmatrix} + \begin{pmatrix}7\\0\end{pmatrix}$

5. Black: $\begin{bmatrix}-0.5 & 0\\ 0 & 0.5\end{bmatrix}\begin{pmatrix}x\\y\end{pmatrix} + \begin{pmatrix}2\\0\end{pmatrix}$ $\quad$ Light gray: $\begin{bmatrix}0.5 & 0\\ 0 & 0.5\end{bmatrix}\begin{pmatrix}x\\y\end{pmatrix}$
Gray: $\begin{bmatrix}0.5 & 0\\ 0 & -0.5\end{bmatrix}\begin{pmatrix}x\\y\end{pmatrix} + \begin{pmatrix}0\\1\end{pmatrix}$

6. $\begin{bmatrix}18 & 15\\ -8 & -13\end{bmatrix}$

7. $\begin{bmatrix}0 & 0 & 1\\ 0 & 1 & 0\\ -1 & 0 & 0\end{bmatrix}$

8. 

9. $\begin{pmatrix}6\\-11\end{pmatrix}$

10. $(7,a,3)\cdot(a,-5,6) = 7a - 5a + 18 = 2a + 18 = 0 \Rightarrow a = -9$

11. $2\begin{bmatrix}9/10 & -3/10\\ -3/10 & 1/10\end{bmatrix} - \begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix} = \begin{bmatrix}4/5 & -3/5\\ -3/5 & -4/5\end{bmatrix}$

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12 6 (hold the cube by opposite edges - there are 6 pairs)
+ 3 (hold the cube by opposite faces - there are 3 pairs) = 9

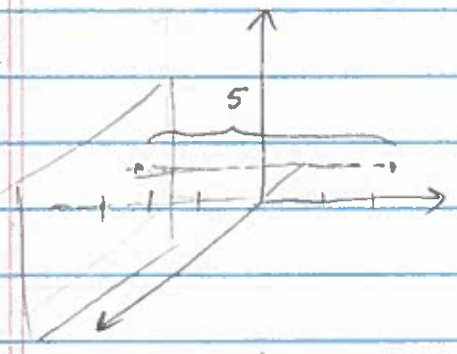
13 $\begin{pmatrix} -5 \\ -11 \\ 2 \end{pmatrix}$

14 1) $\underline{a} \times \underline{b}$ is perpendicular to both $\underline{a}$ and $\underline{b}$
2) $\|\underline{a} \times \underline{b}\|$ is the area of the parallelogram 

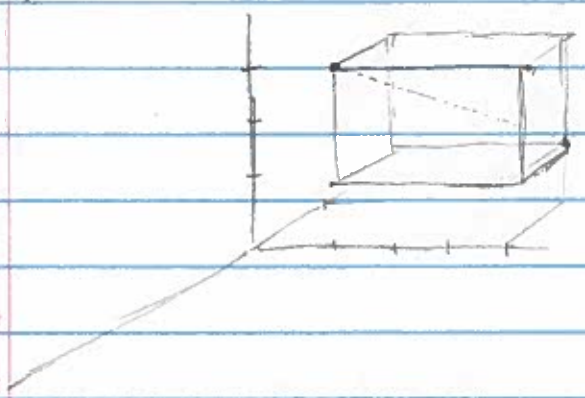
3) The direction of $\underline{a} \times \underline{b}$ follows the right-hand rule.

15 $\begin{pmatrix} 6 \\ 4 \\ 3 \end{pmatrix} - \begin{pmatrix} 3 \\ 2 \\ -1 \end{pmatrix} = \begin{pmatrix} 3 \\ 2 \\ 4 \end{pmatrix}$ $\quad \frac{x-6}{3} = \frac{y-4}{2} = \frac{z-3}{4}$

16 $x + 4y - 3z = 1(3) + 4(-2) - 3(5) = -20$

17 

The perpendicular distance is just the difference in the y-coordinates.

XC 
New corners: (-1, 4, 1)
and $T(3,1,2) = (0,1,3)$