

- Find all values of  $k$  for which the vectors  $[k^2, k, 1]$  and  $[1, 3, 2]$  are orthogonal.
- Find the angle between two diagonals of a cube. (There are four diagonal, it does not matter which pair you choose.)
- What can you say about the angle between two vectors  $\mathbf{u}$  and  $\mathbf{v}$  if
  - $\|\mathbf{u} + \mathbf{v}\| = \|\mathbf{u}\| + \|\mathbf{v}\|$ ,
  - $\|\mathbf{u} + \mathbf{v}\|^2 = \|\mathbf{u}\|^2 + \|\mathbf{v}\|^2$ .
- Find the area of the triangle with vertices  $(0, 1, 3)$ ,  $(2, 1, 4)$ ,  $(1, 3, 2)$ .
- Consider the line through  $(1, 2)$  in the direction  $[3, 4]$ .
  - Put this line in normal form.
  - Find the distance between  $(0, 0)$  and this line.
- Consider the plane  $2x + 3y + 6z = 1$ .
  - Put this line in parametric form.
  - Find the distance between  $(0, 0, 0)$  and this line.
- Find the intersection of  $2x + 3y + 6z = 1$  and  $3x + 2y + 5z = 3$  in parametric form (i.e., solve these simultaneous equations).
- Consider the following matrix

$$A = \begin{bmatrix} 3 & -6 & 1 \\ 2 & -4 & 2 \\ -1 & 2 & 1 \\ 5 & -10 & -1 \end{bmatrix}$$

- Find the rank and nullity of  $A$ .
  - Find a basis for the row space, column space, and null space of  $A$ .
- Find the inverse and determinant of the following matrix

$$B = \begin{bmatrix} 1 & 2 & 3 \\ 3 & 5 & 7 \\ 1 & 2 & 1 \end{bmatrix}$$

- find constants  $A, B, C, D, E$ , such that

$$\frac{x-1}{(x+1)(x^2+1)(x^2+4)} = \frac{A}{x+1} + \frac{Bx+C}{x^2+1} + \frac{Dx+E}{x^2+4}$$