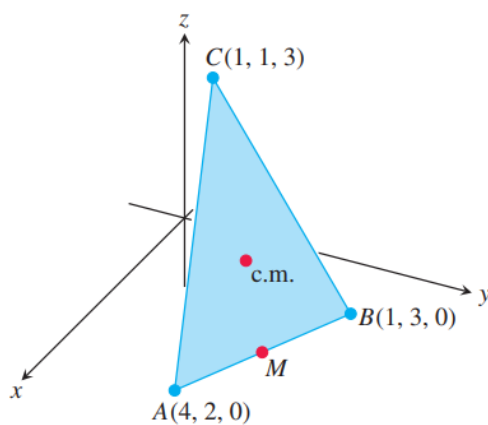


Problem Sheet 1 for the Tutorial, September 29.
(Vectors and the Geometry of Space)

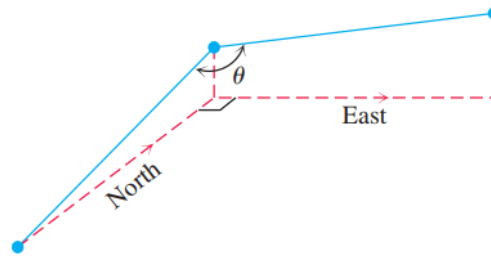
Problem 1. Suppose that A, B , and C are the corner points of the thin triangular plate of constant density shown here.

- Find the vector from C to the midpoint M of side AB .
- Find the vector from C to the point that lies two-thirds of the way from C to M on the median CM .
- Find the coordinates of the point in which the medians of ABC intersect. This point is the plate's center of mass. (See the figure.)



Solution:

Problem 2. A water main is to be constructed with a 20% grade in the north direction and a 10% grade in the east direction. Determine the angle θ required in the water main for the turn from north to east, as it shown in Figure.



Solution:

Problem 3. Given three points in the \mathbb{N}^3 space $P(1, -1, 2)$, $Q(2, 0, -1)$, $R(0, 2, 1)$

- Find the area of the triangle determined by the points P , Q , and R .
- Find a unit vector perpendicular to plane PQR .

Solution:

Problem 4. For what value or values of a will the vectors $u = 2i + 4j - 5k$ and $v = -4i - 8j + ak$ be parallel?

Solution:

Problem 5. Express the velocity vector $v = (e^t \cos t - e^t \sin t)i + (e^t \sin t + e^t \cos t)j$ when $t = \ln 2$ in terms of their lengths and directions.

Solution: