

Math 312 - AB1 Assignment # 1
Due January 18, 2007

Instructions

- This assignment is to be done by you individually - no group work.
- Show all main steps, and give exact answers to all problems.
- Please label the solutions #1, #2, ... on your assignment, rather than by corresponding textbook numbers.
- Bonus marks are available for well-written correct solutions to problems which (i) nobody else solved correctly, or (ii) nobody else attempted by your method.

1. #12 from Section 1.4

2. A metal ring is held in place at the origin of xyz -space by four forces:

- \vec{F}_1 is 4 Newtons of force along the positive x -axis.
- \vec{F}_2 is 5 Newtons of force along the positive y -axis.
- \vec{F}_3 is 8 Newtons of force along the negative z -axis.

Find the magnitude of the fourth force \vec{F}_4 which is balancing the other three, and find its direction angles α, β, γ .

3. The following lines and planes are used in this question:

- Line L_1 : $\vec{R} = (2\hat{i} - 3\hat{j})t + (\hat{i} + \hat{k})$
- Line L_2 : $\frac{x}{6} = \frac{y-4}{3} = z+2$
- Plane P : $3x + 2y - 6z = 11$

- (a) Find equations for L_1 and vector form for L_2 .
- (b) Find the intersection set of L_1 and L_2 (point, line, or empty set).
- (c) Find a unit vector normal to P .
- (d) Find the intersection point of P and L_2 , and the angle at which they cross.
- (e) Show that L_1 is parallel with P , and find the distance between them.

4. Decompose the vector $\vec{v} = 5\hat{i} - 20\hat{j}$ into components parallel with and perpendicular to the vector $\vec{q} = \hat{j} + \hat{k}$.

5. #13 from Section 1.9

6. Find r and s if $(\hat{i} + 2\hat{j} - \hat{k}) \times (r\hat{i} + s\hat{j} + 4\hat{k}) = \vec{0}$

7. Define the points $A(3, 1, 0)$, $B(0, 0, 6)$, $C(1, 0, 2)$, $D(1, 1, 1)$.

- (a) Find the distance from A to D , and find equations for the line through them.
- (b) Find the area of triangle ABC , and find an equation of the plane containing it.
- (c) Find the volume of the tetrahedron $ABCD$.

8. #9 from Section 1.14