Formula-Sheet

Basic Vectors

- A scalar is a physical quantity with magnitude only
- A vector is a physical quantity with magnitude and direction
- A unit vector has magnitude one.
- Magnitude of a vector :$|a| = \sqrt{a_1^2 + a_2^2 + a_3^2}$, if $\bar{a} = a_1 i + a_2 j + a_3 k$
- ***Scalar Product***

  If $\bar{a}$ and $\bar{b}$ are two vectors and θ is the angle between them then the scalar quantity $|\bar{a}||\bar{b}|\cos\theta$ is called the **scalar product** or the **dot product** of $\bar{a}$ and $\bar{b}$ is denoted by $\bar{a}\cdot\bar{b}$.
- If $\bar{a} = a_1 i + a_2 j + a_3 k$ and $\bar{b} = b_1 i + b_2 j + b_3 k$ then $\bar{a}\cdot\bar{b} = a_1 b_1 + a_2 b_2 + a_3 b_3$
- Two vectors $\bar{a}$ and $\bar{b}$ ($\bar{a} \neq 0, \bar{b} \neq 0$) are **perpendicular** if $\bar{a}\cdot\bar{b} = 0$
- ***Vector Product***

  If $\bar{a}$ and $\bar{b}$ are two vectors and θ is the angle between them then the **vector product** of $\bar{a}$ and $\bar{b}$ is defined as a vector $ab\sin\theta\, n$ where n is a unit vector perpendicular to the plane of $\bar{a}, \bar{b}$. The **vector product** or **cross product** of $\bar{a}$ and $\bar{b}$ is denoted by $\bar{a}\times\bar{b}$.
- If $\bar{a} = a_1 i + a_2 j + a_3 k$ and $\bar{b} = b_1 i + b_2 j + b_3 k$ then

  $$\bar{a}\times\bar{b} = \begin{vmatrix} i & j & k \\ a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \end{vmatrix}$$
- **Area of parallelogram of sides $\bar{a}$ and $\bar{b}$ = $|\bar{a}\times\bar{b}|$.**
- **Area of a triangle is** $\Delta = \frac{1}{2}|\bar{a}\times\bar{b}|$ **.**
- **Area of parallelogram when diagonals** $\frac{1}{2}|d_1 \times d_2|$**, where** d_1 **and** d_2 are the diagonals.