### Key Equations

|  |  |
| --- | --- |
| Multiplication by a scalar (vector equation) |  |
| Multiplication by a scalar (scalar equation for magnitudes) |  |
| Resultant of two vectors |  |
| Commutative law |  |
| Associative law |  |
| Distributive law |  |
| The component form of a vector in two dimensions |  |
| Scalar components of a vector in two dimensions | case statement case 1 cap A sub x equals x sub e minus x sub b case 2 cap A sub y equals y sub e minus y sub b |
| Magnitude of a vector in a plane |  |
| The direction angle of a vector in a plane |  |
| Scalar components of a vector in a plane | case statement case 1 cap A sub x equals cap A cosine theta sub cap A case 2 cap A sub y equals cap A sine theta sub cap A |
| Polar coordinates in a plane | case statement case 1 x equals r cosine phi case 2 y equals r sine phi |
| The component form of a vector in three dimensions |  |
| The scalar *z*-component of a vector in three dimensions |  |
| Magnitude of a vector in three dimensions |  |
| Distributive property |  |
| Antiparallel vector to |  |
| Equal vectors | multirelation cap A right arrow equals cap B right arrow left right double arrow case statement case 1 cap A sub x equals cap B sub x case 2 cap A sub y equals cap B sub y case 3 cap A sub z equals cap B sub z |
| Components of the resultant of *N* vectors | case statement case 1 equation sequence part 1 cap F sub cap R times x equals part 2 sum from k equals one to cap N over cap F sub k times x equals part 3 cap F sub one times x plus cap F sub two times x postfix plus ellipsis prefix plus cap F sub cap N times x case 2 equation sequence part 1 cap F sub cap R times y equals part 2 sum from k equals one to cap N over cap F sub k times y equals part 3 cap F sub one times y plus cap F sub two times y postfix plus ellipsis prefix plus cap F sub cap N times y case 3 equation sequence part 1 cap F sub cap R times z equals part 2 sum from k equals one to cap N over cap F sub k times z equals part 3 cap F sub one times z plus cap F sub two times z postfix plus ellipsis prefix plus cap F sub cap N times z |
| General unit vector |  |
| Definition of the scalar product |  |
| Commutative property of the scalar product |  |
| Distributive property of the scalar product |  |
| Scalar product in terms of scalar components of vectors |  |
| Cosine of the angle between two vectors |  |
| Dot products of unit vectors |  |
| Magnitude of the vector product (definition) |  |
| Anticommutative property of the vector product |  |
| Distributive property of the vector product |  |
| Cross products of unit vectors | case statement case 1 i hat times j hat equals prefix plus k hat comma case 2 j hat times k hat equals prefix plus i hat comma case 3 k hat times i hat equals prefix plus j hat period |
| The cross product in terms of scalar components of vectors |  |