1/16/2018 LECTURE NOTES

SUBTRACTION

$\vec{r}_1 = x_1\hat{i} + y_1\hat{j} + z_1\hat{k}$

$\vec{r}_2 = x_2\hat{i} + y_2\hat{j} + z_2\hat{k}$

$\vec{r}_2 - \vec{r}_1 = (x_2 - x_1)\hat{i} + (y_2 - y_1)\hat{j} + (z_2 - z_1)\hat{k}$

GRAPICAL

EXAMPLE - SUBTACT $\vec{r}_2 - \vec{r}_1$

$\vec{r}_1 = 22.5\text{km}\,\hat{i} + 39.0\text{km}\,\hat{j}$

$\vec{r}_2 = 0.0797\text{km}\,\hat{i} + 0.0797\text{km}\,\hat{j} + 0.041\text{km}\,\hat{k}$

TURN THE PROTRACTOR UPSIDE DOWN FOR THE SECOND VECTOR

$\vec{r}_2 - \vec{r}_1 = (0.0797 - 22.5)\text{km}\,\hat{i} + (0.0797 - 39.0)\text{km}\,\hat{j} + (0.04 - 0)\text{km}\,\hat{k}$

$= \boxed{-22.4\text{km}\,\hat{i} - 38.9\text{km}\,\hat{j} + 0.041\text{km}\,\hat{k}}$

MULTIPLICATION

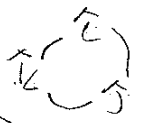
LAW OF COSINES

$\vec{A}\cdot\vec{B} = |A||B|\cos\theta$

LAW OF SINES

$\vec{A}\times\vec{B} = |\vec{A}||\vec{B}|\sin\theta$

CROSS PRODUCT CIRCLE



DOT

CROSS TERMS CANCEL

CROSS TERMS STAY

CROSS

$\vec{A}\cdot\vec{B} = \vec{r}_1\cdot\vec{r}_2 = (x_1\cdot x_2) + (y_1\cdot y_2) + (z_1\cdot z_2)$

$\vec{A}\times\vec{B} = (y_1z_2 - z_1y_2)\hat{i} + (z_1x_2 - x_1z_2)\hat{j} + (x_1y_2 - y_1x_2)\hat{k}$

EXAMPLE

FIND THE DOT AND CROSS PRODUCT

$\vec{r}_1 = 22.5\,km\,\hat{i} + 39.0\,km\,\hat{j}$

$\vec{r}_2 = 0.0797\,km\,\hat{i} + 0.0797\,km\,\hat{j} + 0.041\,\hat{k}$

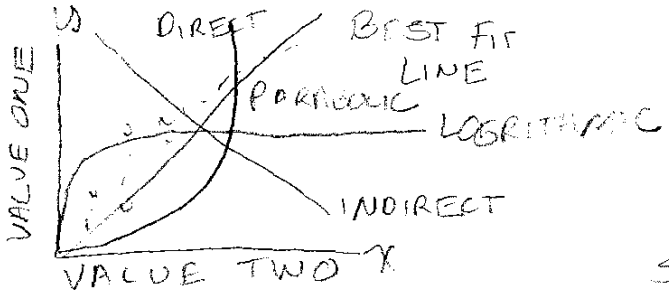
$\vec{r}_1 \cdot \vec{r}_2 = (22.5 \cdot 0.0797)\,km^2 + (39 \cdot 0.0797)\,km^2 + (0 \cdot 0.041)\,km^2$

$= \boxed{4.90\,km^2}$

$\vec{r}_1 \times \vec{r}_2 = (39(0.041) - (0)(0.0797))\,km^2\,\hat{i} + (0(0.0797) - (22.5)(0.041))\,km^2\,\hat{j} + ((22.5)(0.0797) - (39)(0.0797))\,km^2\,\hat{k}$

$= \boxed{1.59\,km^2\,\hat{i} - 0.92\,km^2\,\hat{j} - 1.32\,km^2\,\hat{k}}$

TO FIND THE MAGNITUDE ALONG A CERTAIN AXIS WE NEED TO FIND THE RELATIONSHIP. SOMETIMES WE USE $y = mx + b$ (SLOPE-INTERCEPT)



NEED TO FIND AVERAGE SLOPE AND AVERAGE INTERCEPT

$\text{SLOPE} = m = \frac{\text{RISE}}{\text{RUN}} = \frac{y_2 - y_1}{x_2 - x_1}$

EXAMPLE (THIS MAY NOT BE THE SAME AS IN CLASS)

FIND THE SLOPE INTERCEPT

x	y
0	2) m_1
2	5
4	9) m_2
6	13) m_3
10	18) m_4
12	23) m_5

$m_1 = \frac{5-2}{2-0} = 1.5$

$m_2 = \frac{9-5}{4-2} = 2$

$m_3 = \frac{13-9}{6-4} = 2$

$m_4 = \frac{18-13}{10-6} = 1.25$

$m_5 = \frac{23-18}{12-10} = 2.5$

$m_{AVE} = 1.85$

$y = mx + b$ SOLVE FOR b

$-mx \quad -mx$

$y - mx = b \qquad m = 1.85$

$b_1 = 2 - (1.85)(0) = 2$

$b_2 = 5 - (1.85)(2) = 1.3$

$b_3 = 9 - (1.85)(4) = 1.6$

$b_4 = 13 - (1.85)(6) = 1.9$

$b_5 = 18 - (1.85)(10) = -0.5$

$b_6 = 23 - (1.85)(12) = 0.8$

$b_{AVE} = 1.18$

$$y = 1.85x + 1.18$$