

Math 18, Solns. to selected HW problems, §§ 1.1-1.5, due 9/12

1.1.18, 1.2.12, 1.3.6, 1.4.8, 1.5.12

1.1.18 xy-plane: $z=0 = -d+t$, $t=d$, so intersection is $(3+d, 7+8d, d)$
 $\Rightarrow (7, 23, 0)$

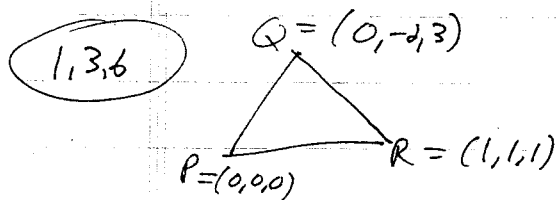
xz-plane: $y=0 = 7+8t$, $t = -\frac{7}{8}$, intersection is $(\frac{5}{4}, 0, -\frac{23}{8})$

yz-plane: $x=0 = 3+dt$, $t = -\frac{3}{d}$, intersection is $(0, 5, -\frac{7}{2})$

1.2.12 Normalize: $\vec{u} \mapsto \frac{\vec{u}}{\|\vec{u}\|}$, $\vec{v} \mapsto \frac{\vec{v}}{\|\vec{v}\|}$

$\|\vec{u}\| = \sqrt{2^2 + 5^2 + 4^2 + 16} = \sqrt{245} = 7\sqrt{5}$, $\frac{\vec{u}}{\|\vec{u}\|} = \frac{15}{7\sqrt{5}}\vec{i} + \frac{-2}{7\sqrt{5}}\vec{j} + \frac{4}{7\sqrt{5}}\vec{k}$

$\|\vec{v}\| = \sqrt{\pi^2 + 9 + 1} = \sqrt{\pi^2 + 10}$, $\frac{\vec{v}}{\|\vec{v}\|} = \frac{\pi}{\sqrt{\pi^2 + 10}}\vec{i} + \frac{3}{\sqrt{\pi^2 + 10}}\vec{j} + \frac{-1}{\sqrt{\pi^2 + 10}}\vec{k}$



Area = $\frac{1}{2} \|\vec{PQ} \times \vec{PR}\| = \frac{1}{2} \|(0, -2, 3) \times (1, 1, 1)\|$
 $= \frac{1}{2} \|(-5, 3, 2)\|$
 $= \frac{1}{2} \sqrt{25 + 9 + 4} = \frac{\sqrt{37}}{2}$

1.4.8 a) $z=x$ b) $z=x$

$z = r \cos \theta$

$\rho \cos \phi = \rho \sin \phi \cos \theta$, or $\cos \phi = \sin \phi \cos \theta$,

or $1 = \tan \phi \cos \theta$

1.5.12 $\det(A+B) \neq \det A + \det B$ in general

Example: $A = \begin{pmatrix} 1 & 0 \\ 0 & 0 \end{pmatrix}$ $\det A = 0$

$B = \begin{pmatrix} 0 & 0 \\ 0 & 1 \end{pmatrix}$ $\det B = 0$

So $\det A + \det B = 0 + 0 = 0$, but

$\det(A+B) = \det \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} = 1$.