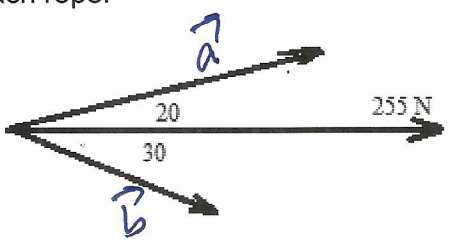
For solutions to these review sheets, see: http://peterseny.faculty.mjc.edu/

Math 173 Exam 1 – Review

Sample Problems – These are meant to be representative of the level of difficulty of what might be on an exam – it's a small sample, not meant to be an all-inclusive list of problem types. The test won't necessarily have the same number of problems.

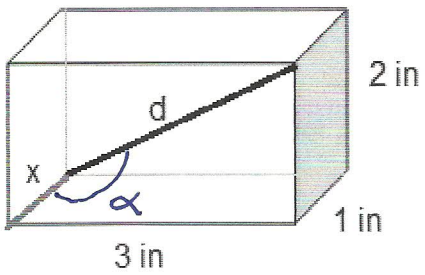
1. (2 pt "filler" problem) Given vectors **a** and **b**, write the formulas for the following. Use magnitudes and angles (not components)
   a) comp $_a$ **b**
   b) proj $_a$ **b**

   a) $\frac{a \cdot b}{|a|}$ b) $\frac{a \cdot b}{|a|^2}\vec{a}$ (or $\frac{a \cdot b}{|a|} \cdot \frac{\vec{a}}{|a|}$) comp$_{ab}$ unit vector in $\vec{a}$ direction
2. A boat is pulled onto shore using 2 ropes as shown, at angles of 20 degrees and 30 degrees from the direction of pulling. If a force of 255 N is needed, find the magnitude of the force in each rope.



$|\vec{a}| \approx 166$ N
$|\vec{b}| \approx 114$ N

3. Find the distance from the point (2, 2, 3) to the plane 2x + y + 2z = 4. $d = 8/3$
4. Find the equation of the plane through points (3, 0, -1), (-2, -2, 3) and (7, 1, -4) $2x+y+3z-3=0$
5. For the quadric surface $x^2 - y^2 + 4z^2 + 2x + 4y + 1 = 0$
   a) Write the equation in standard form $\frac{(x+1)^2}{4} + \frac{(y-2)^2}{4} - z^2 = 1$
   b) Draw traces of the surface for x = -1, y =1, z = 0 (see below)
   c) Sketch the surface in $\mathbb{R}^3$ (hyperboloid in 2 sheets T along y-axis
6. a) Convert the point (0, -1, $\sqrt{3}$) from rectangular to cylindrical and spherical coordinates direction
   b) Find inequalities in spherical coordinates that describe the solid above the xy-plane that lies inside $z = \sqrt{9 - x^2 - y^2}$ a) cyl: $(1, 3\pi/2, \sqrt{3})$ sph: $(2, 3\pi/2, \pi/6)$
7. Find parametric equations for the line tangent to the curve $\boldsymbol{r}(t) = \langle \sqrt{t},\ \ln(t),\ -\frac{1}{t^2+1} \rangle$ at the point $\left(1, 0, -\frac{1}{2}\right)$ b) $\rho \le 3$, $0 \le \theta \le 2\pi$, $0 \le \phi \le \frac{\pi}{2}$ $x = 1 + \frac{1}{2}t$, $y = t$, $z = -\frac{1}{2} + \frac{1}{2}t$
8. Evaluate the integral $\int_0^{\frac{\pi}{4}} (\sec t \tan t\ \boldsymbol{i} + t\cos 2t\ \boldsymbol{j} + \sin^2 2t \cos 2t\ \boldsymbol{k})\ dt$ $(\sqrt{2}-1)\hat{i} + \frac{\pi}{8}\hat{j} + \frac{1}{6}\hat{k}$
9. A rectangular box has dimensions of 1 inch, 2 inches, and 3 inches as shown.
   a) Find the length of the diagonal as shown (from lower back left to upper front right)



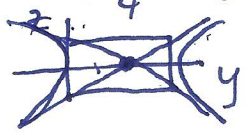
a) $d = \sqrt{14}$ in

b) $\cos\alpha = \frac{\langle 1,3,2 \rangle \cdot \langle 1,0,0 \rangle}{\sqrt{14} \cdot \sqrt{1}} = \frac{1}{\sqrt{14}}$

$\alpha = \cos^{-1}\frac{1}{\sqrt{14}}$

b) Find the angle the diagonal makes with the left-hand edge marked "x".

5b. Trace x = -1 → $\frac{(y-2)^2}{4} - z^2 = 1$ horiz a = 2 b = 1



Trace y = 1 → $\frac{1}{4} - z^2 = 1$ DNE

Trace z = 0 → $\frac{(y-2)^2}{4} - \frac{(x+1)^2}{4} = 1$ vert