

Name \_\_\_\_\_ ID \_\_\_\_\_

MATH 251                      Quiz 1                      Spring 2007  
Sections 509                      Solutions                      P. Yasskin

1-4	/20
5	/ 5
Total	/25

Multiple Choice & Work Out: (5 points each)

1. Find the equation of the sphere with center at  $(4,3,2)$  which passes through the point  $(2,4,0)$ .
- a.  $(x+4)^2 + (y+3)^2 + (z+2)^2 = \sqrt{3}$
  - b.  $(x-4)^2 + (y-3)^2 + (z-2)^2 = 3$
  - c.  $(x-4)^2 + (y+3)^2 + (z-2)^2 = 3$
  - d.  $(x-4)^2 + (y-3)^2 + (z-2)^2 = 9$       Correct Choice
  - e.  $(x+4)^2 + (y-3)^2 + (z+2)^2 = 9$

The vector from the center  $C$  to the point  $P$  is:  $\vec{CP} = P - C = (-2, 1, -2)$

The radius is the length of this vector:  $R = \sqrt{2^2 + 1^2 + 2^2} = 3$

The circle is:  $(x-4)^2 + (y-3)^2 + (z-2)^2 = 9$

2. If  $\vec{u}$  points South East and  $\vec{v}$  points Down, then  $\vec{u} \times \vec{v}$  points
- a. South West
  - b. South East
  - c. Up
  - d. North West
  - e. North East      Correct Choice

Point your right fingers South East with the palm facing Down, your thumb points North East.

3. A wagon is pulled horizontally from the origin  $(0,0)$  to the point  $(4,0)$  meters by the force  $\vec{F} = (2, 1)$  Newtons. Find the work done.
- a. 8 Joules      Correct Choice
  - b. 4 Joules
  - c.  $4\sqrt{5}$  Joules
  - d. 12 Joules
  - e.  $\frac{4}{\sqrt{5}}$  Joules

The displacement vector is  $\vec{D} = (4,0)$ . So the work is  $W = \vec{F} \cdot \vec{D} = 8$  Joules.

4. A triangle has vertices  $P = (2, 1, 3)$ ,  $Q = (2, 4, 0)$ , and  $R = (4, 1, 1)$ . Find the angle at  $P$ .
- $30^\circ$
  - $60^\circ$  Correct Choice
  - $90^\circ$
  - $120^\circ$
  - $150^\circ$

$$\begin{aligned}\vec{PQ} &= Q - P = (0, 3, -3) & \vec{PR} &= R - P = (2, 0, -2) \\ |\vec{PQ}| &= \sqrt{9+9} = 3\sqrt{2} & |\vec{PR}| &= \sqrt{4+4} = 2\sqrt{2} & \vec{PQ} \cdot \vec{PR} &= 6 \\ \cos \theta &= \frac{6}{3\sqrt{2} \cdot 2\sqrt{2}} = \frac{1}{2} & \theta &= 60^\circ & \text{(Use a 30-60-90 triangle.)}\end{aligned}$$

5. A triangle has vertices  $P = (2, 1, 3)$ ,  $Q = (2, 4, 0)$ , and  $R = (4, 1, 1)$ . Find the area of the triangle. Solve this on the back of the Scantron. Show all work.

$$\begin{aligned}\vec{PQ} &= Q - P = (0, 3, -3) & \vec{PR} &= R - P = (2, 0, -2) \\ \vec{PQ} \times \vec{PR} &= \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & 3 & -3 \\ 2 & 0 & -2 \end{vmatrix} = \hat{i}(-6 - 0) - \hat{j}(0 - -6) + \hat{k}(0 - 6) = (-6, -6, -6) \\ A &= \frac{1}{2} |\vec{PQ} \times \vec{PR}| = \frac{1}{2} \sqrt{36 + 36 + 36} = \frac{1}{2} 6\sqrt{3} = 3\sqrt{3}\end{aligned}$$