Vector **r** has initial point $(-11, 4)$ and terminal point $(-8, -6)$. **SCORE: ___ / 5 POINTS**

Vector **s** has magnitude 10 and direction angle $\frac{\pi}{4}$. If $\mathbf{v} = 2\mathbf{s} - 3\mathbf{r}$, write **v** as a linear combination of **i** and **j**.

$\vec{r} = \langle -8 - -11, -6 - 4 \rangle = \langle 3, -10 \rangle$ (1)

$\vec{s} = \langle 10\cos\frac{\pi}{4}, 10\sin\frac{\pi}{4} \rangle = \langle 5\sqrt{2}, 5\sqrt{2} \rangle$ (1)

$\vec{v} = 2\langle 5\sqrt{2}, 5\sqrt{2} \rangle - 3\langle 3, -10 \rangle = \langle 10\sqrt{2} - 9, 10\sqrt{2} + 30 \rangle$

$= (10\sqrt{2} - 9)\vec{i} + (10\sqrt{2} + 30)\vec{j}$ (1) (1) (1)

Let $\mathbf{w} = \mathbf{j} - 4\mathbf{i}$. **SCORE: ___ / 4 POINTS**

[a] Find the component form of the unit vector in the same direction as **w**.

$\frac{1}{\|\vec{w}\|}\vec{w} = \frac{1}{\sqrt{17}}\langle -4, 1 \rangle = \langle \frac{-4}{\sqrt{17}}, \frac{1}{\sqrt{17}} \rangle$

(1) $(1\frac{1}{2})$

[b] Find the component form of the vector with magnitude 3 in the same direction as **w**.

$3\langle \frac{-4}{\sqrt{17}}, \frac{1}{\sqrt{17}} \rangle = \langle \frac{-12}{\sqrt{17}}, \frac{3}{\sqrt{17}} \rangle$ $(1\frac{1}{2})$

Find the magnitude and direction angle of the vector $< -\sqrt{3}, -3 >$. **SCORE: ___ / 2 POINTS**

$\|\langle -\sqrt{3}, -3 \rangle\| = \sqrt{12} = 2\sqrt{3}$ $(\frac{1}{2})$ $\quad \theta = \pi + \tan^{-1}\frac{3}{\sqrt{3}} = \pi + \tan^{-1}\sqrt{3} = \pi + \frac{\pi}{3}$ $(\frac{1}{2})$

$= \frac{4\pi}{3}$ (1)

If $\mathbf{m} = < -5, 7 >$ and $\mathbf{n} = < -2, -4 >$, find $\mathbf{m} \cdot \mathbf{n}$. **SCORE: ___ / 2 POINTS**

$(-5)(-2) + 7(-4) = -18$

(1) (1)

If **g** has magnitude 8, and **h** has magnitude 3, and the angle between the vectors is $\frac{\pi}{6}$, find $\mathbf{g} \cdot \mathbf{h}$. **SCORE: ___ / 2 POINTS**

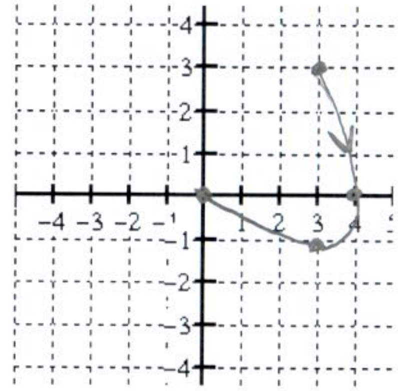
$\|\vec{g}\|\|\vec{h}\|\cos\theta = 8 \cdot 3\cos\frac{\pi}{6} = 12\sqrt{3}$

(1) (1)

Sketch the curve represented by the parametric equations $\begin{array}{l} x = 4 - t^2 \\ y = t^2 - 2t \end{array}$, $-1 \le t \le 2$, and indicate the orientation of the curve.

SCORE: ___ / 4 POINTS

t	x	y
-1	3	3
0	4	0
1	3	-1
2	0	0



Find the simplified rectangular equation corresponding to the parametric equations $\begin{array}{l} x = 3\tan t \\ y = 1 + 2\sec t \end{array}$.

SCORE: ___ / 4 POINTS

$\tan t = \frac{x}{3}$ (1)

$\sec t = \frac{y-1}{2}$ (1)

$\sec^2 t = 1 + \tan^2 t$

$\frac{(y-1)^2}{4} = 1 + \frac{x^2}{9}$

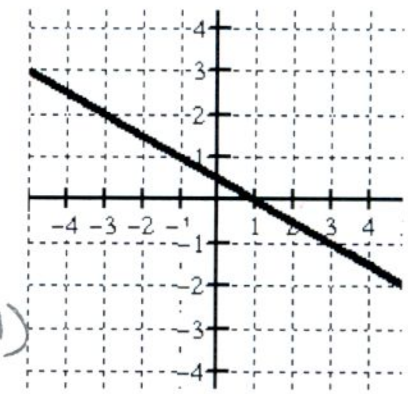
$\frac{(y-1)^2}{4} - \frac{x^2}{9} = 1$

EITHER ONE (2)

The parametric equations $\begin{array}{l} x = 1 - 2t^2 \\ y = t^2 \end{array}$ and $\begin{array}{l} x = 1 - 2\cos 2t \\ y = \cos 2t \end{array}$

SCORE: ___ / 3 POINTS

both correspond to the rectangular equation $x = 1 - 2y$, whose graph is shown on the right. Describe how their plane curves differ from each other.



CURVE 1: $y = t^2$ GOES FROM ∞ TO 0 TO ∞
SO CURVE STARTS AT UPPER LEFT,
GOES DOWN TO X-AXIS AT (1,0)
AND GOES BACK TO UPPER LEFT (2)

CURVE 2: $y = \cos 2t$ GOES BETWEEN -1 AND 1
(1) SO CURVE GOES BETWEEN (3,-1) AND (-1,1)

The diameter of a circle has endpoints $(-5, -11)$ and $(1, -3)$. Find parametric equations for the circle.

SCORE: ___ / 4 POINTS

CENTER $= \left(\frac{-5+1}{2}, \frac{-11+-3}{2}\right) = (-2, -7)$ (1)

RADIUS $= \frac{1}{2}\sqrt{(1--5)^2 + (-3--11)^2}$

$= \frac{1}{2}\sqrt{100}$

$= 5$ (1)

$x = -2 + 5\cos t$

$y = -7 + 5\sin t$

$(\frac{1}{2})$ $(1\frac{1}{2})$