Find the co-ordinates of the vertices and foci, and the equations of the asymptotes of the hyperbola $x^2 - 4y^2 + 10x - 32y - 3 = 0$. **State clearly which co-ordinates are for which points.** **SCORE: ____ / 8 PTS**

$x^2+10x-4y^2-32y=3$

$(x^2+10x+25)-4(y^2+8y+16)=3+25-4\cdot16$

$(x+5)^2-4(y+4)^2=-36$ (2)

$\frac{(y+4)^2}{9}-\frac{(x+5)^2}{36}=1$ (1)

3 ↑ ← $(-5,-4)$

$c^2=9+36=45$

$c=3\sqrt{5}$

CENTER $(-5,-4)$

VERTICES $(-5,-4\pm3)=(-5,-1),(-5,-7)$ (1½)

FOCI $(-5,-4\pm3\sqrt{5})$ (1½)

ASYMPTOTES SLOPE $=\pm\frac{\sqrt{9}}{\sqrt{36}}=\pm\frac{3}{6}=\pm\frac{1}{2}$

$y+4=\pm\frac{1}{2}(x+5)$ (1) (1)

Classify the graph of each equation as a circle, a parabola, an ellipse or a hyperbola. **SCORE: ____ / 2 PTS**

[a] $3x^2-5x+4y^2+4y+1=0$ ELLIPSE (1)

[b] $7x^2+5x+7y^2+12y-2=0$ CIRCLE (1)

A point has polar coordinates $\left(14, \frac{5\pi}{9}\right)$. **SCORE: ____ / 2 PTS**

[a] Find another set of polar coordinates for the point, using a positive value of r.

$(14, \frac{5\pi}{9}\pm2\pi)=(14,\frac{23\pi}{9})$ OR $(14,\frac{-13\pi}{9})$

(1) IF YOU GOT EITHER ANSWER

[b] Find another set of polar coordinates for the point, using a negative value of r.

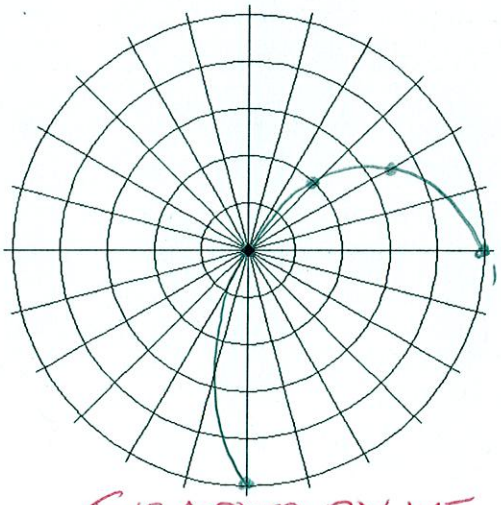
$(-14, \frac{5\pi}{9}\pm\pi)=(-14,\frac{14\pi}{9})$ OR $(-14,\frac{-4\pi}{9})$

(1) IF YOU GOT EITHER ANSWER

Plot the graph of $r = 2\cos\theta - 1$ for $0 \le \theta \le \frac{\pi}{2}$. You must list the polar coordinates for 5 points in that range. **SCORE: ____ / 8 PTS**
Use decimal approximations for irrational values of r.

POINTS ON GRAPH

(5)
- $(1, 0)$
- $(0.7, \frac{\pi}{6})$
- $(0.4, \frac{\pi}{4})$
- $(0, \frac{\pi}{3})$
- $(-1, \frac{\pi}{2})$



GRADED BY ME

Convert the rectangular coordinates $(-9, -3\sqrt{3})$ to polar coordinates. **SCORE: ____ / 4 PTS**

$r = \sqrt{81+27} = \sqrt{108} = 6\sqrt{3}$

$\sin\theta = \frac{-3\sqrt{3}}{6\sqrt{3}} = -\frac{1}{2}$

$\cos\theta = -\frac{9}{6\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = -\frac{9\sqrt{3}}{18} = -\frac{\sqrt{3}}{2}$

$\Big\} \theta = \frac{7\pi}{6}$

(1) IF IN CORRECT ORDER

$(6\sqrt{3}, \frac{7\pi}{6})$

(1) (2)

Convert the polar equation $r^2 = 4 + \sin 2\theta$ to rectangular form. **SCORE: ____ / 6 PTS**

$r^2 = 4 + 2\sin\theta\cos\theta$ (2)

$r^2 = 4 + \frac{2xy}{r^2}$ (1½)

$r^4 = 4r^2 + 2xy$ (1) ← CAN ALSO BE WRITTEN AS $r^2(r^2-4) = 2xy$

$(x^2+y^2)^2 = 4(x^2+y^2) + 2xy$

$(x^2+y^2)(x^2+y^2-4) = 2xy$

(1½) IF YOU GOT EITHER ANSWER