Find the co-ordinates of the vertices and foci, and the equations of the asymptotes of the hyperbola $\frac{(y+13)^2}{16} - \frac{(x-9)^2}{36} = 1$. **State clearly which co-ordinates are for which points.**

SCORE: _____ / 5 PTS

$c^2 = 16 + 36$

$c^2 = 52$

$c = 2\sqrt{13}$

CENTER = $(9, -13)$

VERTICES = $(9, -13 \pm 4) = (9, -9), (9, -17)$

FOCI = $(9, -13 \pm 2\sqrt{13})$

ASYMPTOTES : $m = \pm \frac{\sqrt{16}}{\sqrt{36}} = \pm \frac{4}{6} = \pm \frac{2}{3}$

$y + 13 = \pm \frac{2}{3}(x - 9)$

Find the equations of the following conics.

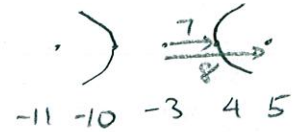
SCORE: _____ / 9 PTS

[a] hyperbola with vertices $(-10, 12)$ and $(4, 12)$, and foci $(5, 12)$ and $(-11, 12)$

CENTER = $\left(\frac{-10+4}{2}, 12\right) = (-3, 12)$

$\frac{(x+3)^2}{49} - \frac{(y-12)^2}{15} = 1$

$\frac{1}{2}$ $\frac{1}{2}$ 1 $1\frac{1}{2}$ $\frac{1}{2}$



$8^2 = 7^2 + b^2$

$b^2 = 64 - 49 = 15$

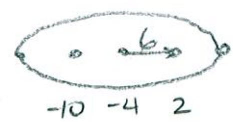
+ 1 FOR CORRECT ORDER OF SUBTRACTION $(x^2 - y^2)$

[b] ellipse with foci $(-10, 11)$ and $(2, 11)$, and major axis of length 16

CENTER = $\left(\frac{-10+2}{2}, 11\right) = (-4, 11)$

$\frac{(x+4)^2}{64} + \frac{(y-11)^2}{28} = 1$

$\frac{1}{2}$ $\frac{1}{2}$ 1 $1\frac{1}{2}$ $\frac{1}{2}$



$2a = 16 \rightarrow a = 8$

$6^2 = 8^2 - b^2$

$b^2 = 64 - 36 = 28$

Using the distance-based definition of a hyperbola, find the equation of the hyperbola with foci $(0, \pm 8)$ such that the distances from any point on the hyperbola to the foci differ by 4. **Show the algebraic work, not just the final answer.**

SCORE: _____ / 9 PTS

IF (x,y) IS ON THE HYPERBOLA,

DISTANCE FROM (x,y) TO $(0,-8)$ $-$ DISTANCE FROM (x,y) TO $(0,8)$ $= \pm 4$

$\sqrt{x^2+(y+8)^2} - \sqrt{x^2+(y-8)^2} = \pm 4$, 2

$\sqrt{x^2+(y+8)^2} = \pm 4 + \sqrt{x^2+(y-8)^2}$, 1

$\cancel{x^2} + \cancel{y^2} + 16y + \cancel{64} = 16 \pm 8\sqrt{x^2+y^2-16y+64} + \cancel{x^2} + \cancel{y^2} - 16y + \cancel{64}$ 2

$32y - 16 = \pm 8\sqrt{x^2+y^2-16y+64}$

$4y - 2 = \pm\sqrt{x^2+y^2-16y+64}$, 1

$16y^2 - \cancel{16y} + 4 = x^2 + y^2 - \cancel{16y} + 64$, 1

$15y^2 - x^2 = 60$, 1

$\frac{y^2}{4} - \frac{x^2}{60} = 1$, 1

Find the co-ordinates of the foci, vertices, and endpoints of the minor axis of the ellipse $4x^2 + y^2 + 16x + 16y + 44 = 0$. **State clearly which co-ordinates are for which points.**

SCORE: _____ / 7 PTS

$4x^2 + 16x + y^2 + 16y = -44$

1 $4(x^2+4x+4) + (y^2+16y+64) = -44 + 4 \cdot 4 + 64$ $\frac{1}{2}$

$4(x+2)^2 + (y+8)^2 = 36$, 1

$\frac{(x+2)^2}{9} + \frac{(y+8)^2}{36} = 1$ $\frac{1}{2}$

$c^2 = 36 - 9 = 27$

$c = 3\sqrt{3}$

CENTER $= (-2,-8)$

VERTICES $= (-2, -8 \pm 6) = (-2,-2), (-2,-14)$, $1\frac{1}{2}$

FOCI $= (-2, -8 \pm 3\sqrt{3})$ $1\frac{1}{2}$

ENDPOINTS OF MINOR AXIS $= (-2 \pm 3, -8) = (1,-8), (-5,-8)$,

1