

Math 32, Extra Credit Homework 11 on sections 10.5, 10.6

Write all your working out and answers on your own notepaper - no need to write the questions. Please use lots of space.

It is very important that you show clearly any work you had to do to get your answers. Just writing the answer down with no work shown is not enough. All 15 questions are worth 2 points each. Hand in your solutions next week only.

Do these first 10 questions and *check that your answers match the solutions on page 2*. If you don't get the same answers then look at your notes or the book or ask me. Only do the last five questions when you are sure you understand the first ten.

(1) Find the vertex, focus, eccentricity and directrix for the conic section $x^2 + 4x + 4 + 4y = 0$. Then sketch its graph.

(2) For the conic section

$$\frac{x^2}{17^2} + \frac{y^2}{8^2} = 1$$

find its foci, vertices, eccentricity and any asymptotes. Then sketch it.

(3) For the conic section

$$\frac{x^2}{15^2} - \frac{y^2}{8^2} = 1$$

find its foci, vertices, eccentricity and any asymptotes. Then sketch it.

(4) Find the equation and eccentricity of the conic section with vertices at $(\pm 4, 0)$ and foci at $(\pm 3, 0)$.

(5) Find the equation and eccentricity of the conic section with vertices at $(\pm 5, 0)$ and asymptotes $y = \pm 2x$.

(6) Give the polar equation of a parabola with focus at the origin and directrix $x = 3$.

(7) Find a polar equation for a conic section with eccentricity $2/3$ and perihelion distance 5. Then find the aphelion distance.

(8) Find the eccentricity and then graph: $r = \frac{8}{2 + 4 \cos \theta}$

(9) The orbit of the comet Tempel 1 has eccentricity 0.51. Its major axis is how many times bigger than its minor axis?

(10) Suppose an interstellar asteroid has a hyperbolic path with eccentricity 1.5 and the sun at one focus. Find the angle in degrees between the incoming and outgoing paths.

Five more questions. Show clearly all your working out and reasoning.

- (11) For the conic section

$$\frac{x^2}{3} - \frac{y^2}{4} = 1$$

find its foci, vertices, eccentricity and any asymptotes.

- (12) Find the equation and eccentricity of the conic section with vertices at $(\pm 3, 0)$ and asymptotes $y = \pm x$.
- (13) Find a polar equation for a conic section with eccentricity $7/8$ and perihelion distance 2. Then find the aphelion distance.
- (14) The orbit of Mercury has eccentricity 0.206. Its major axis is how many times bigger than its minor axis?
- (15) Suppose an interstellar asteroid has a hyperbolic path with eccentricity 4 and the sun at one focus. Find the angle in degrees between the incoming and outgoing paths.

You can also try other questions in the book and listed on the syllabus from sections 10.5, 10.6.

Answers to questions (1)-(10):

- (1) Vertex $(-2, 0)$, focus $(-2, -1)$, eccentricity 1 and the directrix is the line with equation $y = 1$.
- (2) Foci $(\pm 15, 0)$, vertices $(\pm 17, 0)$, eccentricity $e = 15/17$ and no asymptotes. Draw the ellipse making sure it passes through ± 17 on the x -axis and ± 8 on the y -axis.
- (3) Foci $(\pm 17, 0)$, vertices $(\pm 15, 0)$, eccentricity $e = 17/15$ and asymptotes $y = \pm 8/15x$. Draw the hyperbola making sure it passes through ± 15 on the x -axis and gets close to the asymptotes.
- (4) Its equation is $\frac{x^2}{16} + \frac{y^2}{7} = 1$ and its eccentricity is $e = \frac{3}{4}$.
- (5) Its equation is $\frac{x^2}{25} - \frac{y^2}{100} = 1$ and its eccentricity is $e = \sqrt{5}$.
- (6) $r = \frac{3}{1 + \cos \theta}$
- (7) $r = \frac{25}{3 + 2 \cos \theta}$ and the aphelion distance is 25.

- (8) The eccentricity is $e = 2$. Graph this hyperbola making sure it crosses the polar axis (x -axis) at $4/3$ and 4 .
- (9) It is 1.163 times bigger.
- (10) 96.4 degrees.