MATH 30 – WC **ELLIPSE**

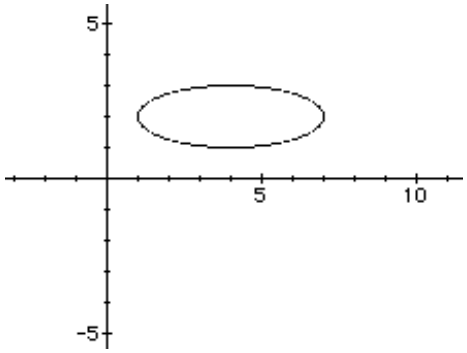
1. For each of the following, determine the center of the ellipse and the endpoints of each axis.
   a. $\frac{x^2}{64}+\frac{y^2}{36}=1$
   b. $\frac{x^2}{16}+\frac{y^2}{49}=1$
   c. $\frac{(x+7)^2}{4}+\frac{(y-5)^2}{25}=1$
   d. $\frac{(x-3)^2}{9}+\frac{(y-8)^2}{100}=1$
   e. $9x^2+16y^2=144$
   f. $49(x+2)^2+7(y-1)^2=36$

Tough Question!

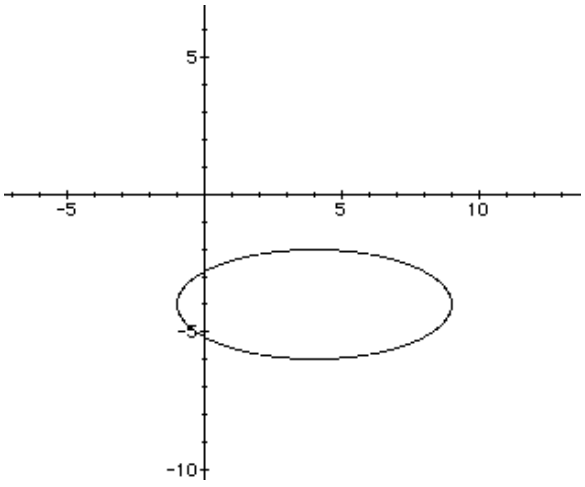
2. Sketch the graph of each of the ellipses in question 1 and check your graph on a graphing calculator. (Write the equation you need to put in your calculator)

3. Write the equation of each of the ellipses below.

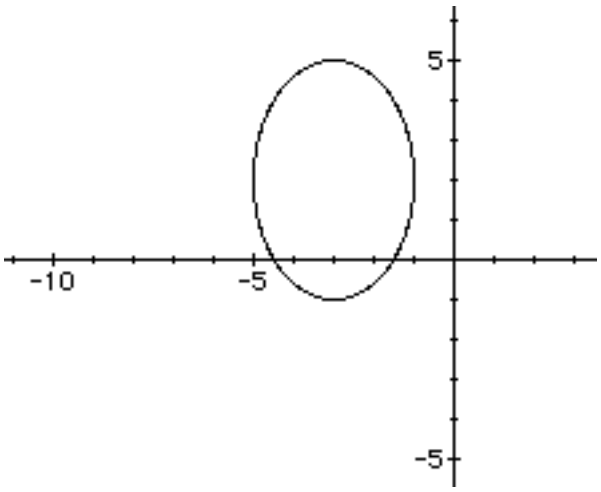
a.



b.



c.



4. Write the equation of an ellipse with a center (3, −2), passing through (−4, −2), (10, −2), (3, 1), and (3, −5).

5. For each ellipse, determine the coordinates of the center, the endpoints of the both axes.

   a. $3x^2 + y^2 + 6x - 8y - 11 = 0$
   b. $x^2 + 121y^2 - 726y + 968 = 0$
   c. $9x^2 + 25y^2 - 9x - 50y - 197.75 = 0$
   d. $16x^2 + 4y^2 + 96x - 8y + 84 = 0$
   e. $4x^2 + 9y^2 + 96x - 16x + 18y - 11 = 0$
   f. $36x^2 + 64y^2 + 108x - 128y - 431 = 0$

6. Change the following to general form.

   a. $\dfrac{x^2}{9} + \dfrac{(y-1)^2}{25} = 1$
   b. $\dfrac{(x-3)^2}{64} + \dfrac{(y+1)^2}{36} = 1$

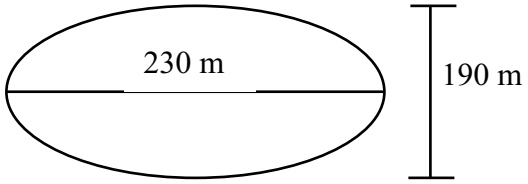
7. Find the equation of an ellipse satisfying the given conditions:

   a. center at (2, 5) with the longer axis of length 12 and parallel to the *x*–axis, shorter axis of length 10

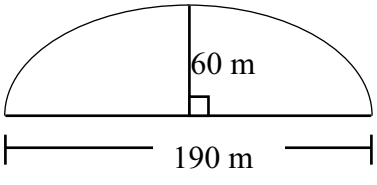
   b. center at (−3, 4) with the longer axis of length 8 and parallel to the *y*–axis, shorter axis of length 2

8. B.C. Place Stadium has an air–filled fabric dome roof that forms the shape of an ellipse when viewed from above. Its maximum length is approximately 230 m, its maximum width is approximately 190 m, and its maximum height is approximately 60 m.

   a. Find an equation for the ellipse formed by the base of the roof.

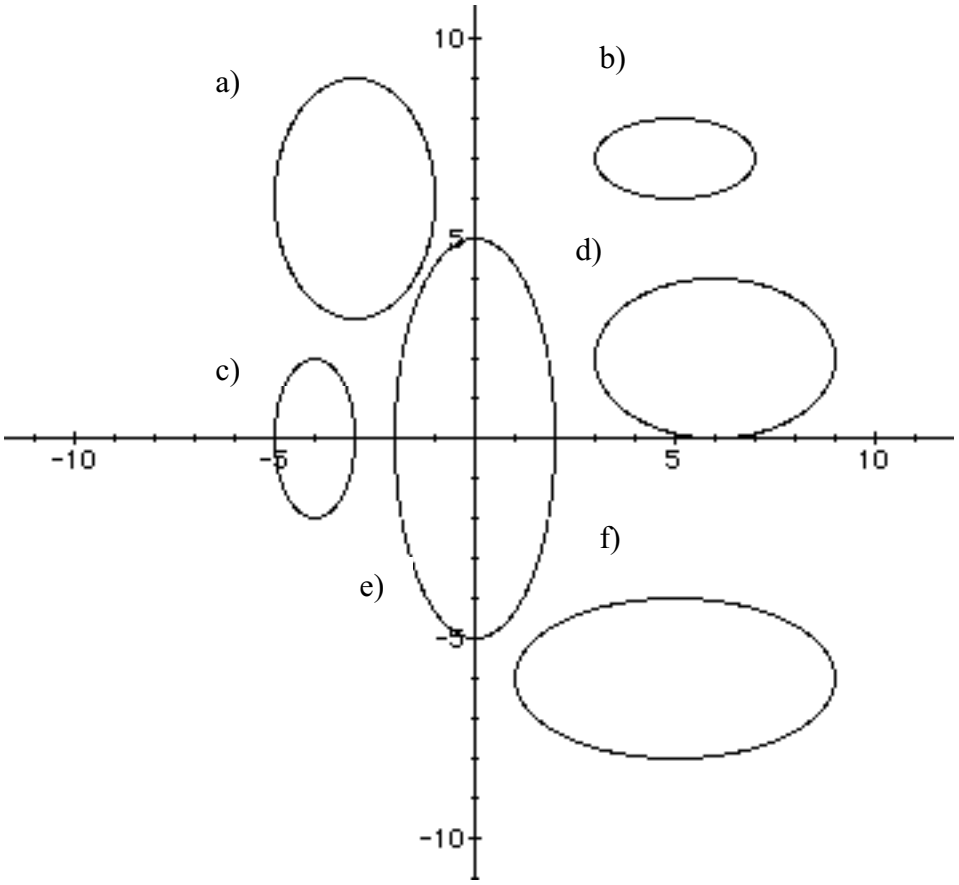


   b. Taking a cross section of the roof at its greatest width results in a semi–ellipse. Find an equation for this semi–ellipse.



c. The promoters of a concert plan to send fireworks up from a point on the stage that is 30 m lower than the center in part b, and 40 m along the major axis of this ellipse from its center. How far is that point on the stage from the roof?

9. Describe the transformations (translations and stretches) that have been applied to the unit circle $x^2 + y^2 = 1$ to produce each of the ellipses below. Then find the standard form of the equation of each ellipse.



Ellipse Worksheet **Answers**

1. For each of the following, determine the centre of the ellipse and the endpoints of each axis.

a) $\frac{x^2}{64}+\frac{y^2}{36}=1$ C(0,0), Endpts(8,0),(–8,0),(0,6),(0,–6)

b) $\frac{x^2}{16}+\frac{y^2}{49}=1$ C(0,0), Endpts(4,0),(–4,0),(0,7),(0,–7)

c) $\frac{(x+7)^2}{4}+\frac{(y-5)^2}{25}=1$ C(–7,5), Endpts(–9,5),(–5,5),(–7,0),(–7,10)

d) $\frac{(x-3)^2}{9}+\frac{(y-8)^2}{100}=1$ C(3,8), Endpts(0,8),(6,8),(3,–2),(3,18)

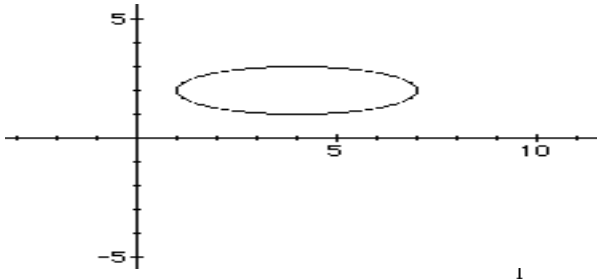
e) $9x^2+16y^2=144$ C(0,0), Endpts(4,0),(–4,0),(0,3),(0,–3)

f) $49(x+2)^2+7(y-1)^2=36$ C(–2,1), Endpts $\left(\frac{-20}{7},1\right),\left(\frac{-8}{7},1\right),\left(-2,1-\frac{6}{\sqrt{7}}\right),\left(-2,1+\frac{6}{\sqrt{7}}\right)$

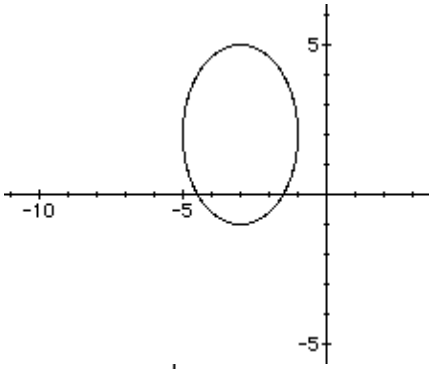
2. Sketch the graph of each of the ellipses in question 1 and check your graph on a graphing calculator. (Write the equation you need to put in your calculator)

3. Write the equation of each of the ellipses below.

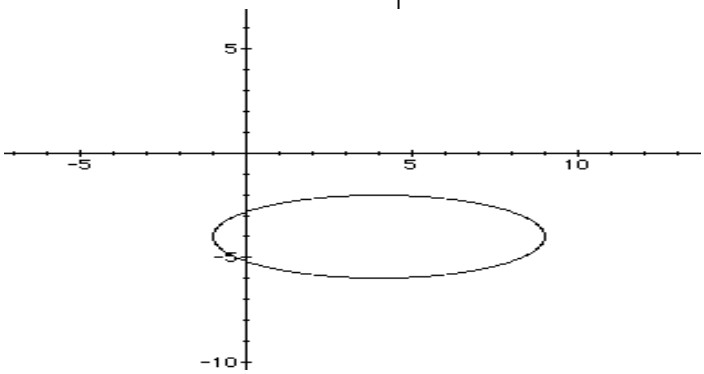
a) $\frac{(x-4)^2}{9}+\frac{(y-2)^2}{1}=1$



b) $\frac{(x-3)^2}{4}+\frac{(y-2)^2}{9}=1$



c) $\frac{(x-4)^2}{25}+\frac{(y-4)^2}{4}=1$



4. Write the equation of an ellipse with a centre (3,–2), passing through (–4,–2), (10,–2), (3,1), and (3,5). $\frac{(x-3)^2}{49}+\frac{(y+2)^2}{9}=1$

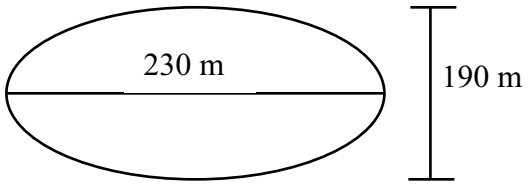
5. For each ellipse, determine the coordinates of the centre, the endpoints of the both axes.
   a) $3x^2+y^2+6x-8y-11=0$ C(–1,4), Endpts $(-1+\sqrt{10},4),(-1-\sqrt{10},4),(-1,4-\sqrt{30}),(-1,4+\sqrt{30})$
   b) $x^2+121y^2-726y+968=0$ C(0,3), Endpts(–11,3),(11,3),(0,2),(0,4)
   c) $9x^2+25y^2-9x-50y-197.75=0$ C(0.5,1), Endpts(–4.5,1),(5.5,1),(0.5,–2),(0.5,4)
   d) $16x^2+4y^2+96x-8y+84=0$ C(–3,1), Endpts(–1,1),(–5,1),(–3,–3),(–3,5)
   e) $4x^2+9y^2+96x-16x+18y-11=0$ C(2,–1), Endpts(–1,–1),(5,–1),(2,–3),(2,1)
   f) $36x^2+64y^2+108x-128y-431=0$ C(–1.5,1), Endpts(–5.5,1),(2.5,1), (–1.5,–2),(–1.5,4)

6. Change the following to general form.
   a) $\frac{x^2}{9}+\frac{(y-1)^2}{25}=1$ $25x^2+9y^2-18y-216=0$
   b) $\frac{(x-3)^2}{64}+\frac{(y+1)^2}{36}=1$ $36x^2+64y^2-216x+128y-1916=0$

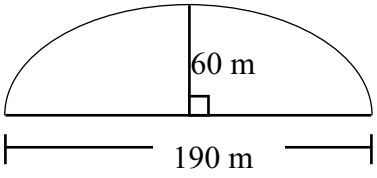
7. Find the equation of an ellipse satisfying the given conditions:
   a) Centre at (2,5) with the longer axis of length 12 and parallel to the *x*–axis, shorter axis of length 10. $\frac{(x-2)^2}{36}+\frac{(y-5)^2}{25}=1$
   b) Centre at (–3,4) with the longer axis of length 8 and parallel to the *y*–axis, shorter axis of length 2 $\frac{(x+3)^2}{1}+\frac{(y-4)^2}{16}=1$

8. B.C. Place Stadium has an air–filled fabric dome roof that forms the shape of an ellipse when viewed from above. Its maximum length is approximately 230 m, its maximum width is approximately 190 m, and its maximum height is approximately 60 m.
   a) Find an equation for the ellipse formed by the base of the roof.

$\frac{x^2}{13225}+\frac{y^2}{9025}=1$



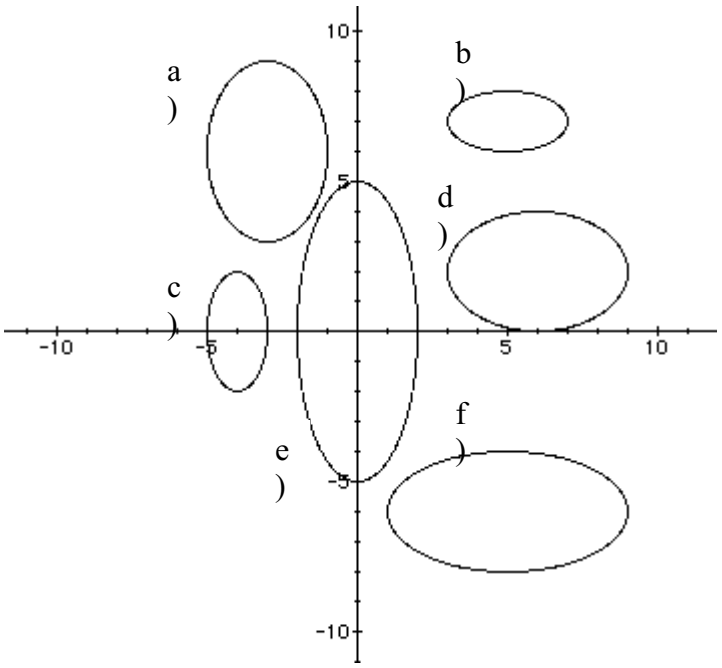
   b) Taking a cross section of the roof at its greatest width results in a semi–ellipse. Find an equation for this semi–ellipse.



$$\frac{x^2}{9025}+\frac{y^2}{3600}=1$$

c) The promoters of a concert plan to send fireworks up from a point on the stage that is 30 m lower than the centre in part b), and 40 m along the major axis of this ellipse from its centre. How far is that point on the stage from the roof? 84.4 m

9. Describe the transformations (translations and stretches) that have been applied to the unit circle $x^2+y^2=1$ to produce each of the ellipses below. Then find the standard form of the equation of each ellipse.



a) Vertical stretch by a factor of 3 about the *x*–axis, horizontal stretch by a factor of 2 about the *y*–axis, up 6, and left 3. $\frac{(x+3)^2}{4}+\frac{(y-6)^2}{9}=1$

b) Vertical stretch by a factor of 3 about the *x*–axis, horizontal stretch by a factor of 2 about the *y*–axis, up 6, and left 3. $\frac{(x-5)^2}{4}+\frac{(y-7)^2}{1}=1$

c) Vertical stretch by a factor of 3 about the *x*–axis, horizontal stretch by a factor of 2 about the *y*–axis, up 6, and left 3. $\frac{(x+4)^2}{1}+\frac{y^2}{4}=1$

d) Vertical stretch by a factor of 3 about the *x*–axis, horizontal stretch by a factor of 2 about the *y*–axis, up 6, and left 3. $\frac{(x-6)^2}{9}+\frac{(y-2)^2}{4}=1$

e) Vertical stretch by a factor of 3 about the *x*–axis, horizontal stretch by a factor of 2 about the *y*–axis, up 6, and left 3. $\frac{x^2}{4}+\frac{y^2}{25}=1$