"What do you get when you cross a rabbit with a kilt?"

Find the vertex of each parabola. The answer to each problem will match a letter that will allow you to figure out the joke.

1. \[ y - 7 = -2(x - 3)^2 \]  
   O: (2, 0)

2. \[ y - 2q = \frac{1}{16}(x - 3)^2 \]  
   H: (-4, -1)

3. \[ y = 4(x - 2)^2 \]  
   A: (3, 10)

4. \[ y = \frac{1}{4}x^2 \]  
   T: (0, 0)

5. \[ x - 2 = \frac{1}{12}(y - 1)^2 \]  
   S: (2, -3)

6. \[ (x - 2) = -\frac{1}{8}(y + 3)^2 \]  
   O: (3, 7)

7. \[ x^2 + 4x = 2y \]  
   U: (0, 4)

8. \[ 4y - 12 = x^2 + 8x \]  
   C: (-2, -2)

9. \[ x^2 + 6x + 4y - 3 = 0 \]  
   H: (-3, 3)

   C: (3, 29)

   S: (2, 3)

   P: (2, 1)

   C: (-2, -3)

Parabolas - Joke #68
“Who wrote the book ‘Split Personalities’?”

Find the equation of the circle given the center C and either the radius r or a point on the circle Z.

<table>
<thead>
<tr>
<th></th>
<th>1. C(0, 0); r = 10</th>
<th>2. C(-3, -4); r = 2</th>
<th>3. C(7, 7); r = √13</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4. C(0, 0); Z(-6, 0)</td>
<td>5. C(-2, -1); Z(9, -1)</td>
<td>6. C(0, -7); Z(0, -9)</td>
</tr>
</tbody>
</table>

Equations:

<table>
<thead>
<tr>
<th></th>
<th>A. (x^2 + y^2 = 36)</th>
<th>N. ((x + 2)^2 + (y + 1)^2 = 121)</th>
<th>D. (x^2 + y^2 = 100)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>U. ((x + 3)^2 + (y + 4)^2 = 4)</td>
<td>C. (x^2 + (y + 7)^2 = 4)</td>
<td>Y. ((x - 7)^2 + (y - 7)^2 = 13)</td>
</tr>
</tbody>
</table>

Match each equation of the circle to its graph below:

<table>
<thead>
<tr>
<th></th>
<th>7. ((x + 2)^2 + (y + 1)^2 = \frac{121}{4})</th>
<th>8. ((x + 2)^2 + (y - 1)^2 = 1)</th>
<th>9. (x^2 + (y - 2)^2 = 16)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10. ((x + 2)^2 + y^2 = \frac{169}{4})</td>
<td>11. ((x + 4)^2 + y^2 = 25)</td>
<td>12. ((x + 2)^2 + (y - 3)^2 = 25)</td>
</tr>
</tbody>
</table>

Q. 

E. 

H. 

J. 

L. 

I.
"What do you call a pumped-up pumpkin?"

Find the center \((h,k)\) and radius \(r\) for the following circle equations. The answer to each problem will match a letter that will allow you to figure out the joke.

1. \((x + 3)^2 + y^2 = 16\)  \hspace{1cm} J: \((0,5)\) and \(r = 2\sqrt{2}\)
2. \((x + 1)^2 + (y - 2)^2 = 3\)  \hspace{1cm} M: \((1,-2)\) and \(r = 3\)
3. \(3x^2 + 3y^2 = 81\)  \hspace{1cm} A: \((0,0)\) and \(r = 3\sqrt{3}\)
4. \(\frac{(x + 1)^2}{16} + \frac{(y - 2)^2}{16} = 1\)  \hspace{1cm} O: \((3,-5)\) and \(r = \sqrt{74}\)
5. \(x^2 + y^2 + 4x - 12 = 0\)  \hspace{1cm} N: \((-\frac{3}{2}, -\frac{1}{2})\) and \(r = \frac{\sqrt{42}}{2}\)
6. \(x^2 + y^2 - 6x - 12y + 36 = 0\)  \hspace{1cm} O: \((-3,0)\) and \(r = 4\)
7. \(x^2 + y^2 - 6x + 10y - 40 = 0\)  \hspace{1cm} T: \((-2,0)\) and \(r = 4\)
8. \(y = x^2 + 4x + y^2\)  \hspace{1cm} L: \((-2,\frac{1}{2})\) and \(r = \frac{\sqrt{17}}{2}\)
9. \(2x^2 + 2y^2 + 4x - 4 = 0\)  \hspace{1cm} C: \((-1,2)\) and \(r = \sqrt{3}\)
10. \(x^2 + 3x = 8 - y^2 - y\)  \hspace{1cm} K: \((-1,0)\) and \(r = \frac{\sqrt{22}}{2}\)
11. A circle with endpoints of a diameter at \((1,4)\) and \((-3,2)\).  \hspace{1cm} N: \((-1,2)\) and \(r = 4\)
12. A circle with endpoints of a diameter at \((-2,3)\) and \((2,7)\).  \hspace{1cm} E: \((3,6)\) and \(r = 3\)

Finding the center and radius for a circle.  \hspace{1cm} R: \((-1,3)\) and \(r = \sqrt{5}\)
"What do you get when you cross an Indian with a cow?"

Match each equation of the ellipse with its graph.

1. \( \frac{(x - 3)^2}{49} + \frac{(y - 1)^2}{4} = 1 \)
2. \( \frac{(x - 4)^2}{9} + \frac{(y + 2)^2}{64} = 1 \)
3. \( \frac{x^2}{4} + \frac{y^2}{9} = 1 \)
4. \( \frac{x^2}{64} + \frac{y^2}{36} = 1 \)
5. \( \frac{(x - 4)^2}{36} + \frac{(y + 1)^2}{81} = 1 \)
6. \( \frac{x^2}{36} + \frac{y^2}{49} = 1 \)
7. \( 9(x + 1)^2 + 4(y - 4)^2 = 36 \)
8. \( 25(x + 4)^2 + 16(y - 4)^2 = 400 \)
9. \( 4(x + 2)^2 + 9(y + 4)^2 = 144 \)
Why did the cemetery worker not like burying the 500 pound man?

Find the center for the following ellipses. The answer to each problem will match a letter that will allow you to figure out the joke.

1. \( \frac{x^2}{25} + \frac{y^2}{36} = 1 \)
   
   \( \text{JO:} \ (-3,0) \)

2. \( \frac{(x - 2)^2}{4} + \frac{(y - 3)^2}{9} = 1 \)
   
   \( \text{TA:} \ (0,2) \)

3. \( 36y^2 + 4(x - 2)^2 = 144 \)
   
   \( \text{TH:} \ (5,-6) \)

4. \( 2x^2 + (y - 2)^2 = 32 \)
   
   \( \text{ER:} \ (-1,3) \)

5. \( \frac{(x + 1)^2}{16} + \frac{(y - 2)^2}{4} = 1 \)
   
   \( \text{RU:} \ (0,0) \)

6. \( 2x^2 + y^2 + 4x = 2 \)
   
   \( \text{KI:} \ (0,-1) \)

7. \( 4x^2 + y^2 + 8x - 6y + 9 = 0 \)
   
   \( \text{ND:} \ (2,0) \)

8. \( x^2 + 10x + 4y^2 + 48y = -153 \)
   
   \( \text{SA:} \ (2,3) \)

9. \( x^2 + 3y^2 + 6x + 6 = 0 \)
   
   \( \text{IT:} \ (-5,-6) \)

10. \( 2x^2 + 8x + 4y^2 - 24y + 4 = 0 \)
   
   \( \text{MA:} \ (-1,2) \)

11. \( 3x^2 + 4y^2 + 8y = 8 \)
   
   \( \text{NG:} \ (-1,0) \)

   \( \text{WA:} \ (-2,3) \)

   \( \text{RA:} \ (2,4) \)
"WHAT DO YOU CALL A GOVERNMENT COUNT OF PRISONERS?"

Match the following equations to its corresponding graph below.

1. \( \frac{(x)^2}{9} - \frac{(y)^2}{16} = 1 \)
2. \( \frac{(y)^2}{16} - \frac{(x)^2}{9} = 1 \)
3. \( \frac{(x+2)^2}{4} - \frac{(y-1)^2}{9} = 1 \)
4. \( \frac{(x-2)^2}{4} - \frac{(y+1)^2}{9} = 1 \)
5. \( \frac{(y+1)^2}{9} - \frac{(x-1)^2}{9} = 1 \)
6. \( \frac{(x-1)^2}{9} - \frac{(y+1)^2}{9} = 1 \)
“What's the name of the snake that joined the Canadian police force?”

Find the center of each hyperbola. The answer to each problem will match a letter that will allow you to figure out the joke.

1. \(\frac{y^2 - x^2}{9} = \frac{1}{36}\)
   \[P: (3,-2)\]
   \[Y: (4,3)\]

2. \((y + 1)^2 - 4x^2 = 16\)
   \[N: (1,0)\]
   \[S: (0,1)\]

3. \(\frac{(x + 2)^2}{11} - \frac{(y + 3)^2}{25} = 1\)
   \[B: (-1,-2)\]
   \[Y: (1,-4)\]

4. \((x - 1)^2 - 4(y + 4)^2 = 64\)
   \[H: (0,-1)\]
   \[O: (-3,2)\]

5. \(4y^2 - x^2 - 16y + 2x + 11 = 0\)
   \[A: (-2,1)\]
   \[U: (0,0)\]

6. \(y^2 - 3x^2 + 6x + 6y = 18\)
   \[T: (-2,3)\]

7. \(4x^2 - 25y^2 - 8x - 96 = 0\)
   \[E: (-2,-3)\]
   \[W: (1,1)\]

8. \(144y^2 - 25x^2 - 576y - 150x = 324\)
   \[M: (1,-3)\]

9. \(25x^2 - 4y^2 + 100x + 24y - 36 = 0\)
   \[I: (1,2)\]

10. \(3y^2 - 4x^2 + 12y + 24x = 36\)

Hyperbolas — finding the center

Joke #5A
### Conics

Classify the conic section.

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>
| 1. | \[
\frac{(x + 3)^2}{25} - \frac{(y + 1)^2}{36} = 1 \] | 2. | \[
\frac{-1}{28^2} \] |
| 3. | \[x^2 + y^2 = 196\] | 4. | \[
\frac{x^2}{16} + \frac{y^2}{9} = 1 \] |
| 5. | \[
\frac{x - 1}{12} = \frac{(y - 4)^2}{1} \] | 6. | \[
\frac{(x - 5)^2}{1} + \frac{(y - 8)^2}{9} = 1 \] |
| 7. | \[
\frac{x + 2}{24} = \frac{(y + 6)^2}{1} \] | 8. | \[
\frac{(y - 4)^2}{64} - \frac{(x + 1)^2}{16} = 1 \] |
| 9. | \[
\frac{x}{8} = \frac{-y^2}{1}\] | 10. | \[
x^2 + y^2 = \frac{49}{9}\] |
| 11. | \[
\frac{x - 2}{40} = \frac{(y - 9)^2}{1} \] | 12. | \[
\frac{x^2}{81} + \frac{y^2}{49} = 1 \] |
| 13. | \[
\frac{x}{4} = \frac{-y^2}{1}\] | 14. | \[
\frac{(x - 8)^2}{1} + \frac{(y + 2)^2}{4} = 1 \] |
| 15. | \[
\frac{x^2}{49} - \frac{y^2}{64} = 1 \] | 16. | \[
\frac{y^2}{36} - \frac{x^2}{25} = 1 \] |
Conics

Match the equation of the parabola, circle, or ellipse with its graph.

\[ y + 1 = -\frac{1}{16}(x + 2)^2 \]
\[ y + 2 = \frac{1}{12}(x + 2)^2 \]
\[ (x + 1)^2 + y^2 = 9 \]
\[ \frac{x^2}{36} + \frac{y^2}{49} = 1 \]
\[ (x - 3)^2 + (y + 3)^2 = 9 \]
\[ (x - 4)^2 + (y - 1)^2 = 1 \]

http://www.edhelper.com/conics35.htm

1/19/2005
Examples: See Sections 9.1 - 9.3 for examples.

Graph.
1. \( x^2 + y^2 = 16 \)
2. \( x^2 + y^2 = 36 \)
3. \( x^2 + y^2 + 2x - 4y - 4 = 0 \)

4. \( x^2 + y^2 - 8x - 10y + 5 = 0 \)
5. \( \frac{x^2}{36} + \frac{y^2}{100} = 1 \)
6. \( \frac{x^2}{49} + \frac{y^2}{16} = 1 \)

7. \( 4x^2 + y^2 = 36 \)
8. \( 4x^2 + 25y^2 = 100 \)
9. \( \frac{x^2}{36} - \frac{y^2}{64} = 1 \)
10. \( \frac{y^2}{81} - \frac{x^2}{9} = 1 \)

11. \( 4x^2 - 49y^2 = 196 \)

12. \( 16y^2 - 9x^2 = 144 \)

13. \( \frac{x^2}{64} + y^2 = 1 \)

14. \( \frac{y^2}{25} - \frac{x^2}{4} = 1 \)

15. \( 16x^2 - 36y^2 = 144 \)

16. \( x^2 + y^2 = 81 \)

17. \( x^2 + 9y^2 = 36 \)

18. \( x^2 + y^2 + 6x - 10y - 15 = 0 \)
Conic Sections:

Systems of Non-Linear Equations in Two Variables can be solved using the same techniques as used in chapter 7. Solve each of the following systems by the method indicated:

Elimination:
\[
\begin{align*}
    x^2 - y^2 &= 3 \\
    x^2 + y^2 &= 5
\end{align*}
\]

Substitution:
\[
\begin{align*}
    x^2 + y^2 &= 20 \\
    y &= x^2
\end{align*}
\]

Elimination:
\[
\begin{align*}
    x^2 - 6x - y &= -5 \\
    x^2 - 6x + y &= -5
\end{align*}
\]
Suppose a certain system of nonlinear equations involves a circle and a parabola. On graph paper, sketch the system so that it has:

1. no solution
2. one solution
3. two solutions
4. three solutions
5. four solutions

7.) Orbit of a Comet.
If the sun is placed at the center of a coordinate system, the path of Halley’s comet can be approximated the parabola $2y^2 - 9x = 18$. How far is the comet from the sun at the vertex of the orbit? All distances are in astronomical units (AU).

8.) An Absolutely Fascinating Application to Archeology
A fragment of a bowl is found. If placed on a coordinate system, the bowl’s edge touches the points $(0,10)$, $(0,-10)$, and $(4,0)$. What is the radius of the bowl?
Hints: Start with the standard form of the equation of a circle. You’re looking for $h$, $k$ and $r$. Substitute in the ordered pairs given to get new equations. You will have to use techniques from section 13.4 and chapter 7.
"What is the sun's other job?"

Solve the following arithmetic sequences and series. The answer to each problem will match a letter that will allow you to figure out the joke.

1. Find $a_n$ in the arithmetic sequence: $-7, -3, 1, 5, ...$
   A: \frac{107}{3}
   l: -4, 20, 32
   G: 440
   U: 320
   R: -4, 24, 36
   N: \frac{103}{3}
   O: -10

2. Find $a_{26}$ for $1, \frac{7}{3}, \frac{11}{3}, ...$

3. If $a_n = -84$ in the arithmetic sequence $6, 1, -4, ...$, find $n$.

#4-5, find the missing terms for the following arithmetic sequence.

4. 5, ____ , ____ , ____ , -7
5. ____ , 8, ____ , ____ , 44

#6-10, find $s_n$ for each arithmetic series described.

6. $a_1 = 12, a_n = 100, n = 12$
   M: 7, 11, 15
   H: 33
   I: 14
   T: -30, -27, -24
   L: 77
   G: 672
   N: 504

7. $a_1 = 42$, $n = 8$, $d = 6$

8. $8 + 6 + 4 + ... + -10$

9. $\sum_{n=1}^{3}(2n + 1)$

10. $\sum_{p=1}^{6}(2p - 3)$

#11-12, find the first terms of each arithmetic series.

11. $a_1 = 7$, $a_n = 83$, $s_n = 400$
   O: 2, -1, -4

12. $n = 16$, $a_n = 15$, $s_n = -120$
   K: -2, -6, -10
   P: 7, 14, 21

Arithmetic sequences and series Joke #48
"What do you call spooky sausages?"

Solve the following geometric sequences and series. The answer to each problem will match a letter that will allow you to figure out the joke.

1. Find the $n$th term of the geometric sequence in which $a_1 = 128$, $n = 9$, and $r = \frac{1}{2}$.
   - A: $\frac{121}{4}$
   - I: $\frac{1}{2}$

2. Find $a_n$ for $\frac{2}{3}, \frac{4}{3}, \frac{8}{3}, ...$
   - T: $-2$

3. Find the common ratio, $r$, for the geometric sequence: $2, -8, 32, -128, ...$
   - W: $12, 18$

4. Write the first three terms of the geometric sequence: $a_1 = 20$ and $r = -3$
   - L: $20, -60, 180$

5. Find the missing terms for the following geometric sequence: $8, _, _, 27$
   - O: $-183$
   - G: $14.3, 20.6$

#6-10, find sum for each geometric series described.

6. $a_1 = 64$, $r = \frac{3}{2}$, $n = 4$
   - S: $-11718$

7. $a_1 = -2$, $r = 3$, $a_n = -54$
   - N: $4$

8. $\frac{1}{q} + \frac{1}{3} + ... + q$
   - H: $2$

9. $a_1 = -3$, $r = 5$, $n = 6$
   - E: $-4$

10. $\sum_{n=1}^{3} (-3)^n$
    - R: $-80$

#11-12, find $a_n$ for each geometric series described.

11. $s_n = -364$, $r = -3$, $n = 6$
    - E: $520$

12. $n = 8$, $s_n = 13,120$, $r = 3$
    - P: $450$

Geometric sequences and series

Joke #44
Raising Binomials To Powers

\[(x+y)^0 = 1\]
\[(x+y)^1 = x + y\]
\[(x+y)^2 = x^2 + 2xy + y^2\]
\[(x+y)^3 = x^3 + 3x^2y + 3xy^2 + y^3\]
\[(x+y)^4 = x^4 + 4x^3y + 6x^2y^2 + 4xy^3 + y^4\]
\[(x+y)^5 = x^5 + 5x^4y + 10x^3y^2 + 10x^2y^3 + 5xy^4 + y^5\]
\[(x+y)^6 = x^6 + 6x^5y + 15x^4y^2 + 20x^3y^3 + 15x^2y^4 + 6xy^5 + y^6\]
\[(x+y)^7 = \text{????????? ??????????}\]

See any patterns?
GOOD! Now we don't have to FOIL
FOIL FOIL the expansion of \((x+y)^7\).
Work out the variables first.....
And for the coefficients.....
This pattern is called Pascal's Triangle. It is used to help find the coefficients of terms in binomial expansions. Use the pattern from the previous page and Pascal's triangle to find the expansion for the following:

1. 

$$(x + y)^7$$

2. 

$$(2x - y)^5$$

3. 

$$(3x - 2y)^4$$

A specific term in an expansion can be found by the formula: $(r + 1)\text{st term} = \binom{n}{r} a^{n-r} b^r$

Where $$\binom{n}{r} = \frac{n!}{(n-r)!r!}$$

4. Find $5^{\text{th}}$ term in the expansion $(2x - 3y)^7$

5. Find the $4^{\text{th}}$ term in the expansion $(x - 2y)^9$