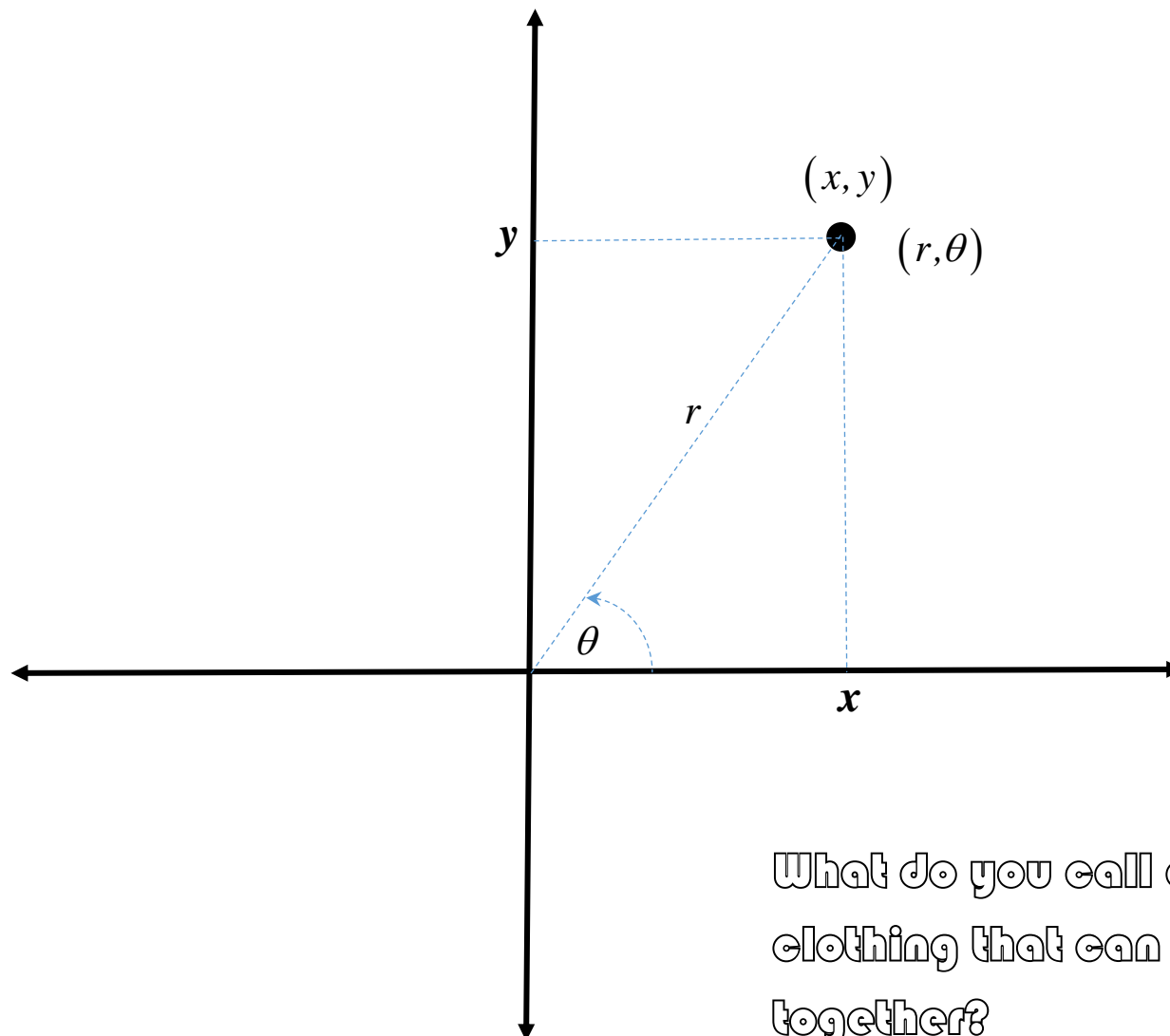## *Polar Coordinates:*

There is an alternative method for locating points in the plane called polar coordinates.

(x, y)

y

(r, θ)

r

θ

x

What do you call arctic clothing that can be worn together?

Rectangular/Cartesian coordinates are unique. Polar coordinates are not unique.

Example:

1. Find polar coordinates for the point with rectangular coordinates $(1,1)$**.**

2. Find polar coordinates for the point with rectangular coordinates $(0,0)$**.**

<u>Conversion Equations:</u>

$$x^2 + y^2 = r^2$$

$$x = r\cos\theta$$

$$y = r\sin\theta$$

$$\tan\theta = \frac{y}{x}$$

THIS YEAR'S POLAR CO-ORDINATES

BLAIR

Examples:

1. Find polar coordinates for the rectangular coordinates $\left(-\sqrt{3},1\right)$.

2. Find rectangular coordinates for the polar coordinates $\left(4,\dfrac{4\pi}{3}\right)$.

3. Transform the rectangular coordinate equation $x^2 + y^2 = 4$ into an equivalent polar coordinate equation, and graph the solution curve.

4. Transform the rectangular coordinate equation $x = 3$ into an equivalent polar coordinate equation, and graph the solution curve.

5. Transform the rectangular coordinate equation $y = x^2$ into an equivalent polar coordinate equation, and graph the solution curve.

6. Transform the polar coordinate equation $r \sin\theta = 2$ into an equivalent rectangular coordinate equation, and graph the solution curve.

7. Transform the polar coordinate equation $r = 2\cos\theta$ into an equivalent rectangular coordinate equation, and graph the solution curve.

8. Transform the polar coordinate equation $r = \sin\theta - \cos\theta$ into an equivalent rectangular coordinate equation, and graph the solution curve.
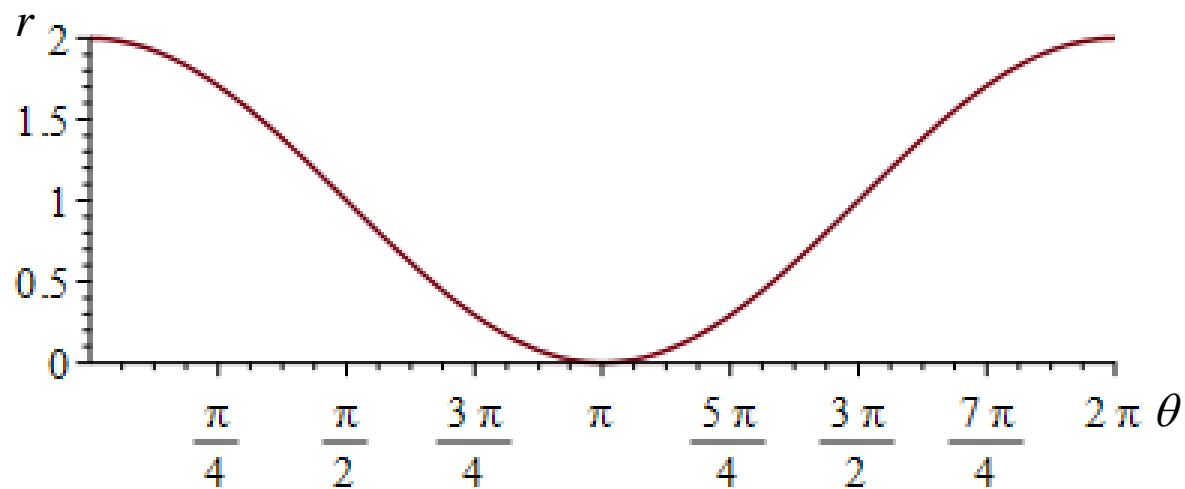
Special Polar Coordinate Equations/Graphs:

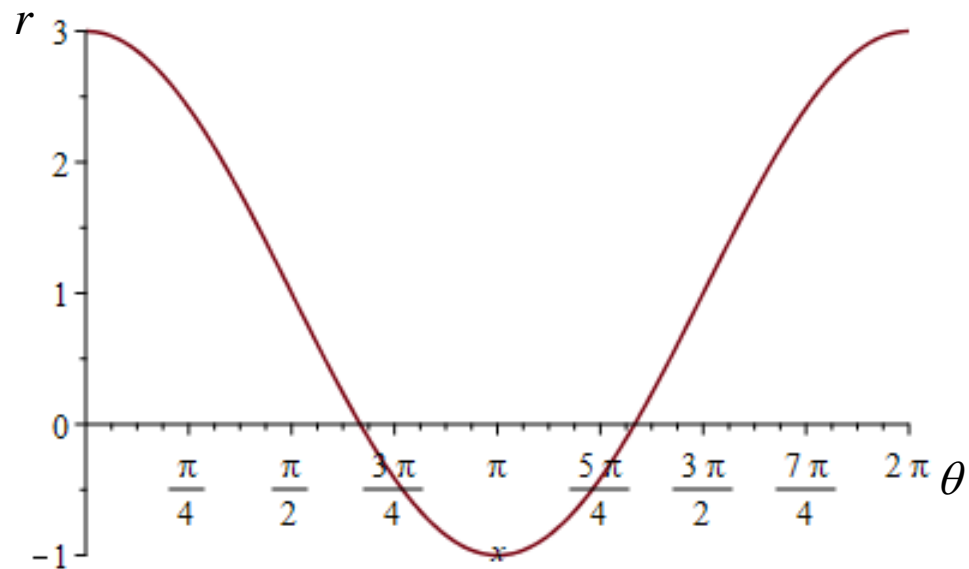r vs. θ

Cardioid:

1. $r = 1 + \cos\theta$

2. $r = 2(1 - \sin\theta)$

Cardioid with an Inner Loop:
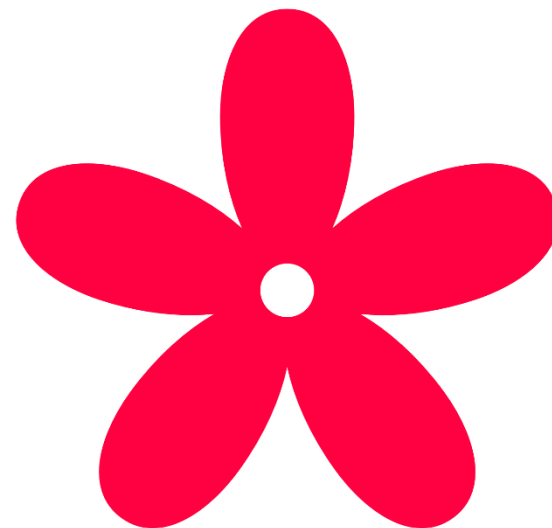
1. $r = 1 + 2\cos\theta$
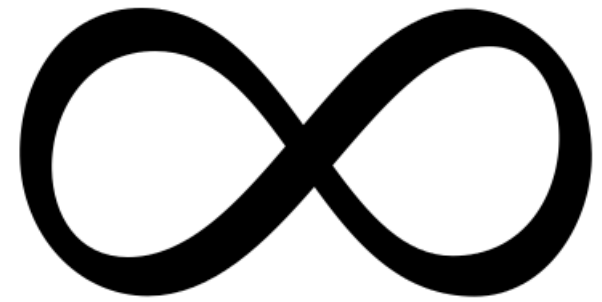
r vs. θ

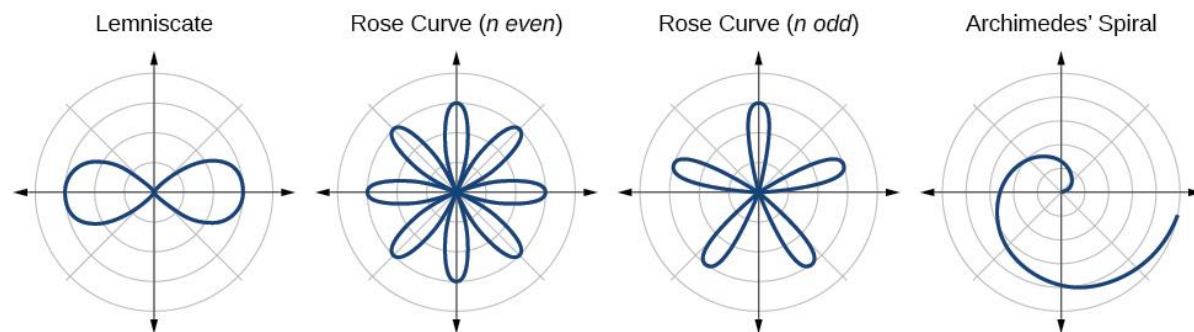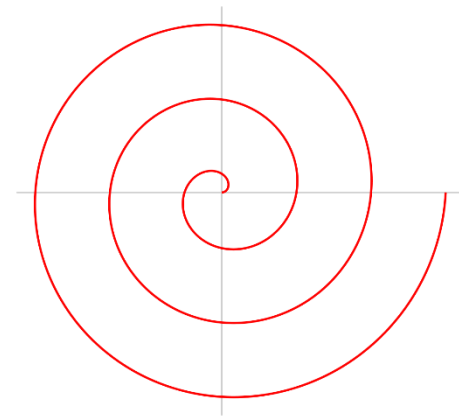**2.** $r = 1 + 2\sin\theta$

Rose:

$$r = 2\sin(2\theta)$$

Lemniscate:

$$r^2 = \cos(2\theta)$$
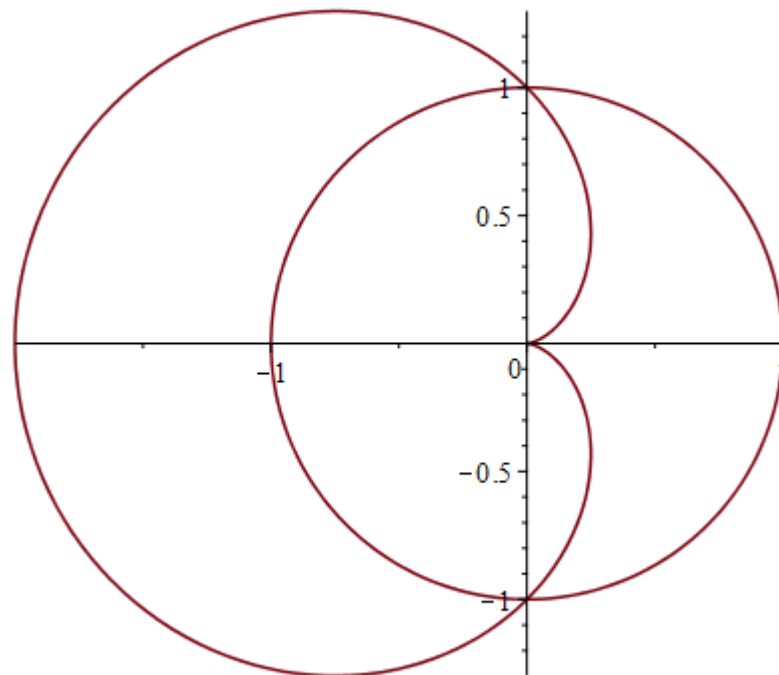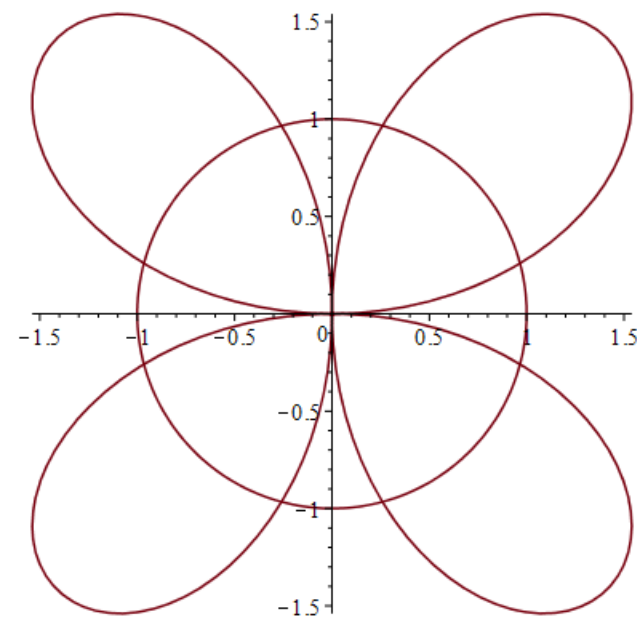
Spiral:

$$r = \theta; \theta \geq 0$$

Lemniscate   Rose Curve (*n even*)   Rose Curve (*n odd*)   Archimedes' Spiral

Intersections of Polar Graphs:

1. Find the points of intersection of the graphs of the polar coordinate equations $r=1$
and $r=1-\cos\theta$**.**

2. Find the points of intersection of the graphs of the polar coordinate equations $r = 1$ and $r = 2\sin(2\theta)$.

3. Find the points of intersection of the graphs of the polar coordinate equations $r = 1 - \cos\theta$ **and** $r = \cos\theta$.