AP Precalc

4.9 Vector-Valued Functions

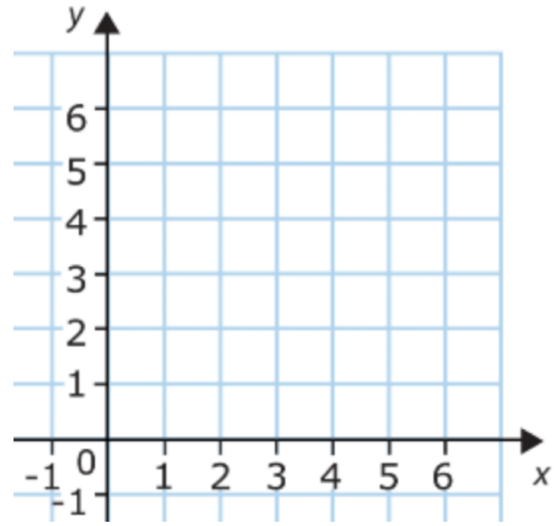
4.9 Notes

Write your questions and thoughts here!

The position of a particle moving in a plane that is given by the parametric function, $f(t) = (x(t),\ y(t))$ may be expressed as a **vector-valued function,** $p(t) = \langle x(t),\ y(t)\rangle$. The **magnitude** of the position vector at time *t*, gives the distance of the particle from the origin.

Ex 1: Consider the vector-valued function, $f(t) = \langle t+2, t^2\rangle$.

t	*x*	*y*
-2		
-1		
0		
1		
2		



What shape is formed going left to right?

The **domain** of a vector-valued function is the intersection of the domains of both component functions.

Ex 2: Find the domains of each of the components of the vector-valued function, then find the domain of the vector-valued function.

$f(t) = \left\langle t^2 - 3, \frac{t+3}{t-2}\right\rangle$

$f(t) = \left\langle \sqrt{x+4} - 4, \frac{t}{t-5}\right\rangle$

The vector-valued function $v(t) = \langle x(t), y(t)\rangle$ can be used to express the velocity of a particle moving in a plane at different times, *t*. At time *t*, the sign of the *x(t)* indicates if the particle is moving left or right, and the sign of the *y(t)*, indicates if the particle is moving up or down. The magnitude of the velocity vector at time, t, gives the speed of the particle.

Write your questions

Ex 3: Describe the motion and find the speed of a particle in motion with the following vector at the given time.

$$v(t) = \langle 2\cos t, 4\sin t \rangle, t = \frac{\pi}{3}$$

4.9 Vector-Valued Functions

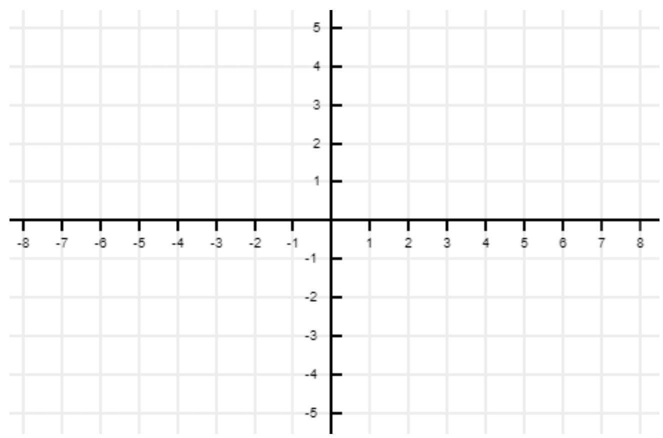
AP Precalculus

4.9 Practice

Directions: For the given vector-valued functions, complete the table and sketch the graph that the endpoints make.

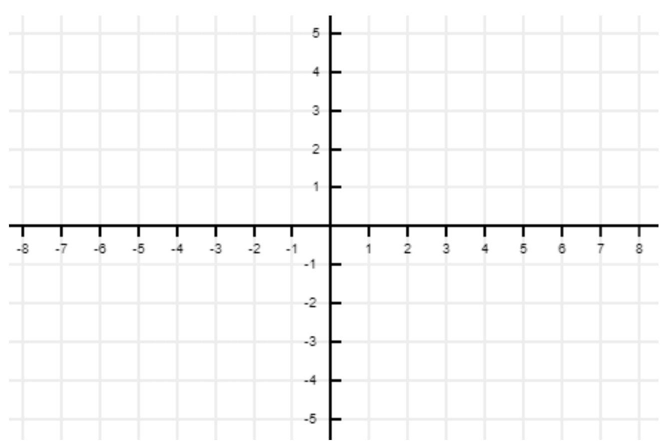
1) $f(t) = \langle t^2, t - 2 \rangle$.

t	x	y
-2		
-1		
0		
1		
2		



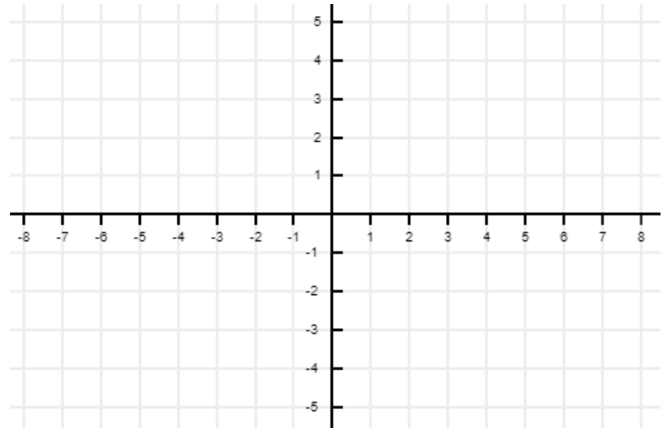
2) $f(t) = \left\langle t + 4, \frac{4}{t} \right\rangle$

t	x	y
-12		
-8		
-4		
0		
4		



3) $f(t) = \langle 4\cos t, 2\sin t \rangle$

t	x	y
0		
$\frac{\pi}{6}$		
$\frac{\pi}{4}$		
$\frac{\pi}{3}$		
$\frac{\pi}{2}$		



Directions: Find the domains of each of the components of the vector-valued function, then find the domain of the vector-valued function.

4) $f(t) = \left\langle 3t - 4, \frac{3}{t} \right\rangle$

5) $f(t) = \left\langle \sqrt{x} - 3, \frac{t}{t-5} \right\rangle$

6) $f(t) = \langle 2t^3, |t| \rangle$

7) $f(t) = \left\langle \sqrt{t-3}, \frac{2t}{t-6} \right\rangle$

Directions: Describe the motion and find the speed of a particle in motion with the following vector at the given time.

8) $v(t) = \langle -4\cos t, 8\sin t \rangle, t = \frac{\pi}{4}$

9) $v(t) = \langle 2(t-3)^2, \sqrt{2t-3} \rangle, t = 6$

10) $v(t) = \left\langle \frac{5t-4}{t}, 2t^3 \right\rangle, t = -2$	11) $v(t) = \left\langle \frac{-t^2-5}{t}, -\sqrt{t-4} \right\rangle, t = 5$

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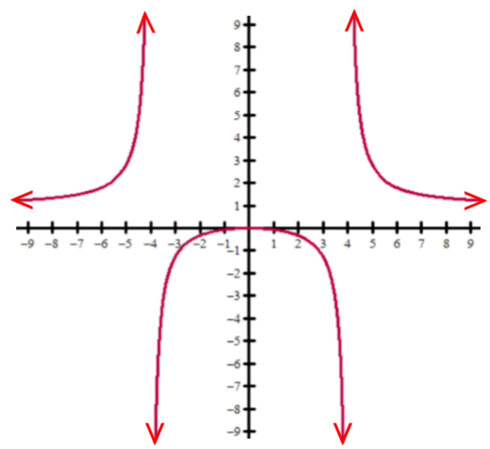
4.9 Test Prep

12. (1.9) Given the graph of f. Which of the following describes the functio



(A) $\lim_{x\to -4^-} f(x) = -\infty$ and $\lim_{x\to -4^+} f(x) = -\infty$

(B) $\lim_{x\to -4^-} f(x) = \infty$ and $\lim_{x\to -4^+} f(x) = -\infty$

(C) $\lim_{x\to -4^-} f(x) = -\infty$ and $\lim_{x\to -4^+} f(x) = \infty$

(D) $\lim_{x\to -4^-} f(x) = \infty$ and $\lim_{x\to -4^+} f(x) = \infty$

(E) $\lim_{x\to -4} f(x) = f(0)$

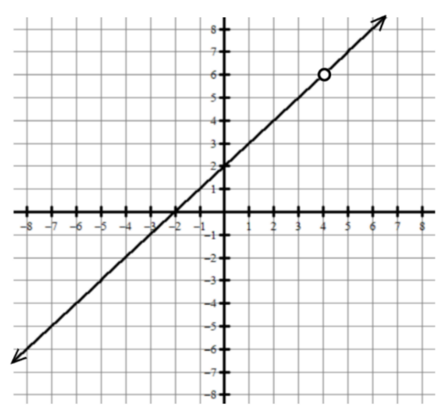
12. (1.10) The figure shows the graph of a function f. Which of the following could be an expression for the $f(x)$?

(A) $\frac{(x+2)(x-4)}{(x+2)}$

(B) $\frac{(x-2)(x+4)}{(x-2)}$

(C) $\frac{(x+2)(x-4)}{(x-4)}$

(D) $\frac{(x-2)(x+4)}{(x+4)}$



graph of f