Assignment Previewer

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INSTRUCTOR
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HW3 (Homework)

Current Score: – / 28 POINTS | 0.0 %

Scoring and Assignment Information

QUESTION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
POINTS	– / 2	– / 6	– / 2	– / 1	– / 2	– / 1	– / 1	– / 4	– / 1	– / 1	– / 1	– / 1	– / 1	– / 2	– / 1	– / 1

Assignment Submission

For this assignment, you submit answers by questions.

Assignment Scoring

Your best submission for each question part is used for your score.

1. [– / 2 Points] 0/5 Submissions Used DETAILS

scalcet9m 13.2.003.nva

Consider the given vector equation.

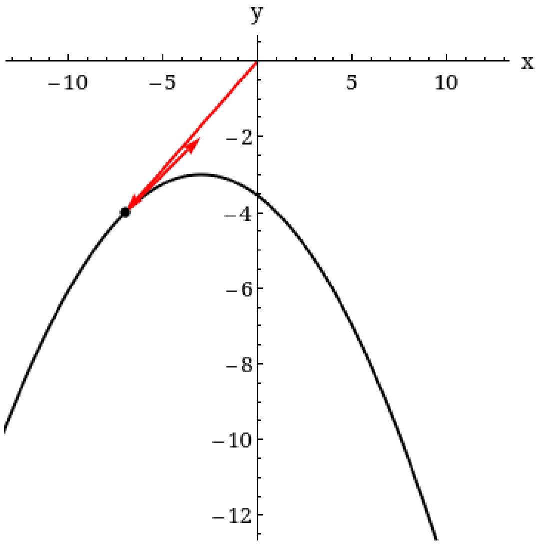
$\mathbf{r}(t) = \langle 4t - 3, t^2 + 3 \rangle$

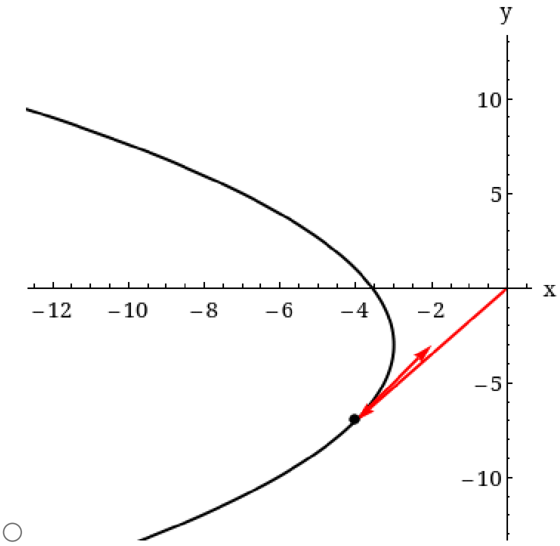
(a) Find $\mathbf{r}'(t)$.

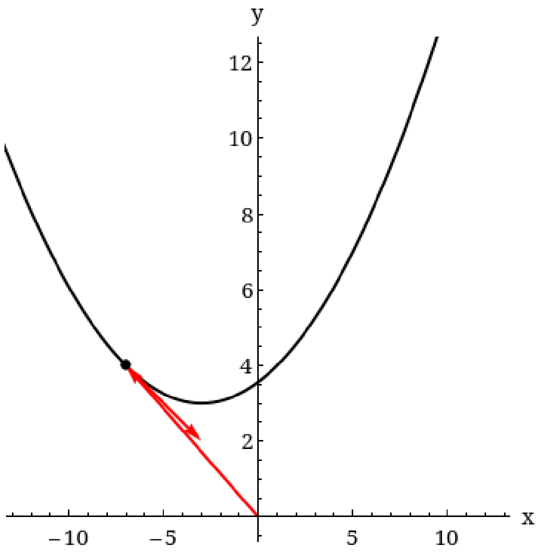
$\mathbf{r}'(t) =$

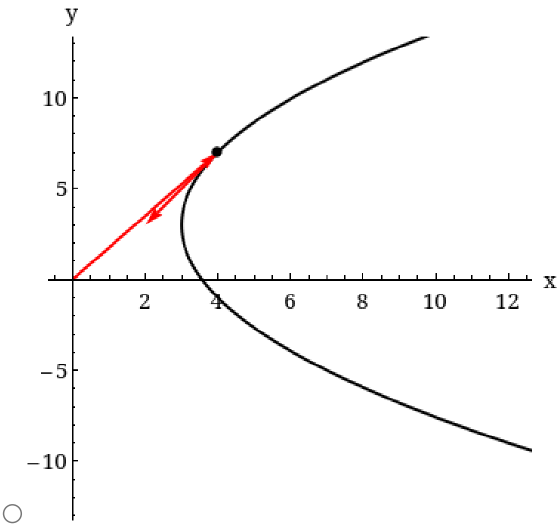
✖ $\langle 4, 2t \rangle$

(b) Sketch the plane curve together with the position vector $\mathbf{r}(t)$ and the tangent vector $\mathbf{r}'(t)$ for the given value of $t = -1$.









✖

Solution or Explanation

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Resources

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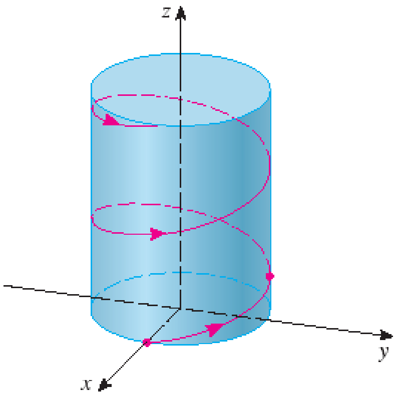
2. [–/6 Points] 0/5 Submissions Used DETAILS

SCalcET9M 13.1.AE.004.



Video Example

EXAMPLE 4 Sketch the curve whose vector equation is

$\mathbf{r}(t) = 3\cos(t)\,\mathbf{i} + 3\sin(t)\,\mathbf{j} + 5t\mathbf{k}.$

SOLUTION The parametric equations for this curve are

$x =$ ✗ $3\cos(t)$, $y = 3\sin(t)$, $z =$ ✗ $5t$.

$x^2 + y^2 =$

Since ✗ $9\cos^2(t)$ + $9\sin^2(t)$ = ✗ 9, the curve must lie on the circular cylinder $x^2 + y^2 =$ ✗ 9. The point (x, y, z) lies directly above the point $(x, y, 0)$, which moves counterclockwise around the circle $x^2 + y^2 =$ ✗ 9 in the xy-plane. (The projection of the curve onto the xy-plane has vector equation $\mathbf{r}(t) = \langle 3\cos(t), 3\sin(t), 0\rangle$. See this example.) Since $z = 5t$, the curve spirals upward around the cylinder as t increases. The curve, shown in the figure, is called a **helix**.

3. [– / 2 Points] 0/5 Submissions Used **DETAILS**

SCalcET9M 13.1.024.

Find a vector equation and parametric equations for the line segment that joins P to Q.

$P(a, b, c)$, $Q(u, v, w)$

vector equation $\mathbf{r}(t) =$

✗ $\langle t(u-a)+a, t(v-b)+b, t(w-c)+c\rangle$

parametric equations $(x(t), y(t), z(t)) = \Big($

✗ $t(u-a)+a, t(v-b)+b, t(w-c)+c$ $\Big)$

Solution or Explanation

We take $\mathbf{r}_0 = \langle a, b, c\rangle$ and $\mathbf{r}_1 = \langle u, v, w\rangle$. Then, by the equation that states

the line segment from $\mathbf{r}_0$ to $\mathbf{r}_1$ is given by the vector equation $\mathbf{r}(t) = (1-t)\mathbf{r}_0 + t\mathbf{r}_1$, $0 \le t \le 1$,

we have a vector equation for the line segment

$$\mathbf{r}(t) = (1-t)\mathbf{r}_0 + t\mathbf{r}_1 = (1-t)\langle a, b, c\rangle + t\langle u, v, w\rangle \quad \Rightarrow$$
$$\mathbf{r}(t) = \langle a + (u-a)t, b + (v-b)t, c + (w-c)t\rangle, \quad 0 \le t \le 1$$

with corresponding parametric equations $x = a + (u-a)t$, $y = b + (v-b)t$, $z = c + (w-c)t$, $0 \le t \le 1$.

4. [– / 1 Points] 0/5 Submissions Used **DETAILS**

SCalcET9M 13.2.011.

Find the derivative, $\mathbf{r}'(t)$, of the vector function.

$$\mathbf{r}(t) = t^4\,\mathbf{i} + \cos(t^3)\,\mathbf{j} + \sin^2(t)\,\mathbf{k}$$

$\mathbf{r}'(t) =$

✗ $\langle 4t^3, -3t^2\sin(t^3), 2\sin(t)\cos(t)\rangle$

Solution or Explanation

$$\mathbf{r}(t) = t^4\,\mathbf{i} + \cos(t^3)\,\mathbf{j} + \sin^2(t)\,\mathbf{k} \quad \Rightarrow$$

$$\mathbf{r}'(t) = 4t^3\,\mathbf{i} + \left[-\sin(t^3)\cdot 3t^2\right]\mathbf{j} + (2\sin(t)\cdot\cos(t))\,\mathbf{k} = 4t^3\,\mathbf{i} - 3t^2\sin(t^3)\,\mathbf{j} + 2\sin(t)\cos(t)\,\mathbf{k}$$

5. [– / 2 Points] 0/5 Submissions Used

DETAILS

SCalcET9M 13.1.023.

Find a vector equation and parametric equations for the line segment that joins P to Q.

$P(0, -4, 2)$, $Q\left(\frac{1}{2}, \frac{1}{3}, \frac{1}{4}\right)$

vector equation $\mathbf{r}(t) =$

✗ $\left\langle \frac{t}{2}, \frac{13t}{3} - 4, 2 - \frac{7t}{4} \right\rangle$

parametric equations $(x(t), y(t), z(t)) =$ (

✗ $\frac{t}{2}, \frac{13t}{3} - 4, 2 - \frac{7t}{4}$)

Solution or Explanation

Taking $\mathbf{r}_0 = \langle 0, -4, 2 \rangle$ and $\mathbf{r}_1 = \left\langle \frac{1}{2}, \frac{1}{3}, \frac{1}{4} \right\rangle$, we have $\mathbf{r}(t) = (1 - t)\,\mathbf{r}_0 + t\,\mathbf{r}_1 = (1 - t)\langle 0, -4, 2 \rangle + t\left\langle \frac{1}{2}, \frac{1}{3}, \frac{1}{4} \right\rangle$, $0 \le t \le 1$ or $\mathbf{r}(t) = \left\langle \frac{1}{2}t, -4 + \frac{13}{3}t, 2 - \frac{7}{4}t \right\rangle$, $0 \le t \le 1$. Parametric equations are $x = \frac{1}{2}t$, $y = -4 + \frac{13}{3}t$, $z = 2 - \frac{7}{4}t$, $0 \le t \le 1$.

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6. [– / 1 Points] 0/5 Submissions Used

DETAILS

SCalcET9M 13.1.032.

Find an equation of the plane that contains the curve with the given vector equation.

$\mathbf{r}(t) = \langle t, t^5, t \rangle$

✗ $z = x$

Solution or Explanation

We have $\mathbf{r}(t) = \langle t, t^5, t \rangle$. Consider the projection of the curve in the xz-plane, $\mathbf{r}(t) = \langle t, 0, t \rangle$. This is the line $z = x$, $y = 0$. Thus, the curve is contained in the plane $z = x$.

7. [– / 1 Points] 0/5 Submissions Used

DETAILS

SCalcET9M 13.1.VE.001.

Watch the video below then answer the question.

Click **here** to view the transcript

The curve $r(t) = (4\cos(t))\mathbf{i} - (4\sin(t))\mathbf{j} + (t)\mathbf{k}$ is similar to a spring along the z-axis.

- True
- False

Solution or Explanation

True

8. [– / **4 Points**] 0/5 Submissions Used

DETAILS

SCalcET9M 13.1.003.EP.

Find each of the following limits.

$\lim_{t\to 0} e^{-6t} =$

✗ 1

$\lim_{t\to 0} \frac{t^2}{\sin^2(t)} =$

✗ 1

$\lim_{t\to 0} \sin(7t) =$

✗ 0

Find the limit of the given vector function.

$$\lim_{t\to 0}\left(e^{-6t}\,\mathbf{i} + \frac{t^2}{\sin^2(t)}\,\mathbf{j} + \sin(7t)\,\mathbf{k}\right)$$

✗ $\mathbf{i} + \mathbf{j}$

Solution or Explanation

We have $\lim_{t\to 0} e^{-6t} = e^0 = 1,$

$$\lim_{t\to 0}\frac{t^2}{\sin^2(t)} = \lim_{t\to 0}\frac{1}{\frac{\sin^2(t)}{t^2}} = \frac{1}{\lim_{t\to 0}\frac{\sin^2(t)}{t^2}} = \frac{1}{\left(\lim_{t\to 0}\frac{\sin(t)}{t}\right)^2} = \frac{1}{1^2} = 1,$$

and $\lim_{t\to 0}\sin(7t) = \sin(0) = 0.$

Thus, the given limit equals $\mathbf{i} + \mathbf{j}$.

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9. [– / 1 Points] 0/5 Submissions Used

DETAILS

SCalcET9M 13.1.003.

Find the limit.

$$\lim_{t\to 0}\left(e^{-5t}\,\mathbf{i} + \frac{t^2}{\sin^2(t)}\,\mathbf{j} + \tan(6t)\,\mathbf{k}\right)$$

✕ $\mathbf{i}+\mathbf{j}$

Solution or Explanation

Click to View Solution

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10. [– / 1 Points] 0/5 Submissions Used

DETAILS

SCalcET9M 13.1.034.

Find an equation of the plane that contains the curve with the given vector equation.

$$\mathbf{r}(t) = \langle 8t, \sin(t), t + 6\rangle$$

✕ $x = 8z - 48$

Solution or Explanation

We have $\mathbf{r}(t) = \langle 8t, \sin(t), t + 6\rangle$. Consider the projection in the xz-plane, $\mathbf{r}(t) = \langle 8t, 0, t + 6\rangle$. This is the line with parametric equations

$$x = 8t,\ z = t + 6,\ y = 0 \quad \Rightarrow \quad x = 8t = 8(z - 6) = 8z - 48,\ y = 0.$$

Thus, the curve is contained in the plane $x = 8z - 48$.

11. [– / 1 Points] 0/5 Submissions Used

DETAILS

SCalcET9M 13.1.037.

Selected three different surfaces that contain the curve $\mathbf{r}(t) = 6t\,\mathbf{i} + e^{t}\,\mathbf{j} + e^{6t}\,\mathbf{k}$ from the list below. (Select all that apply.)

- [ ] $y = z^6$
- [ ] $z = e^x$
- [ ] $z = y^6$
- [ ] $z = 6x + e^x y$
- [ ] $x = \ln(y)$
- [ ] $y = e^{x/6}$

✗

Solution or Explanation

Here $x = 6t$, $y = e^t$, $z = e^{6t}$. Then $t = \frac{x}{6} \Rightarrow y = e^t = e^{x/6}$, so the curve lies on the surface $y = e^{x/6}$. Also $z = e^{6t} = e^x$, so the curve lies on the surface $z = e^x$. Since $z = e^{6t} = (e^t)^6 = y^6$, the curve also lies on the surface $z = y^6$.

12. [– / 1 Points] 0/5 Submissions Used

DETAILS

SCalcET9M 13.1.002.

Find the domain of the vector function. (Enter your answer using interval notation.)

$$\mathbf{r}(t) = \cos(t)\,\mathbf{i} + \ln(t)\,\mathbf{j} + \frac{1}{t-6}\,\mathbf{k}$$

✗ $(0, 6), (6, \infty)$

Solution or Explanation

The component functions $\cos(t)$, $\ln(t)$, and $\frac{1}{t-6}$ are all defined when $t > 0$ and $t \neq 6$, so the domain of $\mathbf{r}$ is $(0, 6) \cup (6, \infty)$.

13. [– / 1 Points] 0/5 Submissions Used

DETAILS

SCalcET9M 13.1.057.

If two objects travel through space along two different curves, it's often important to know whether they will collide. (Will a missile hit its moving target? Will two aircraft collide?) The curves might intersect, but we need to know whether the objects are in the same position *at the same time*. Suppose the trajectories of two particles are given by the vector functions

$$\mathbf{r}_1(t) = \langle t^2, 12t - 35, t^2 \rangle \qquad \mathbf{r}_2(t) = \langle 11t - 28, t^2, 13t - 42 \rangle$$

for $t \geq 0$. Find the values of t at which the particles collide. (Enter your answers as a comma-separated list. If an answer does not exist, enter DNE.)

t =

✖ 7

Solution or Explanation

Click to View Solution

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14. [–/2 Points] 0/5 Submissions Used

DETAILS

SCalcET9M 13.2.005.

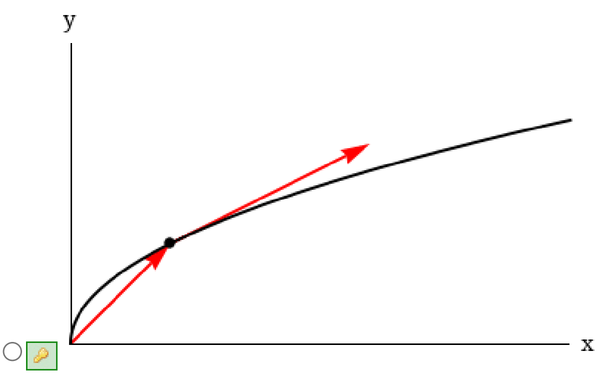
Consider the given vector equation.

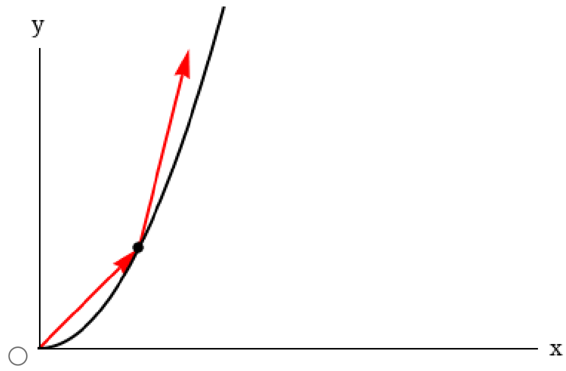
$\mathbf{r}(t) = e^{10t}\,\mathbf{i} + e^{5t}\,\mathbf{j}$

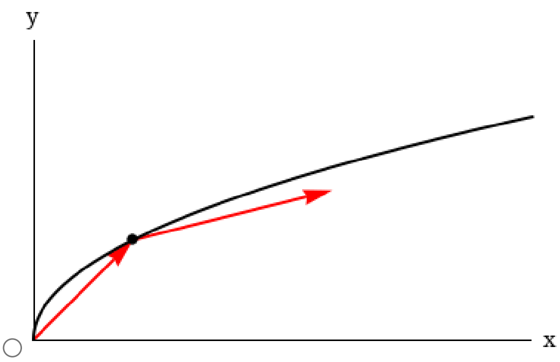
(a) Find $\mathbf{r}'(t)$.

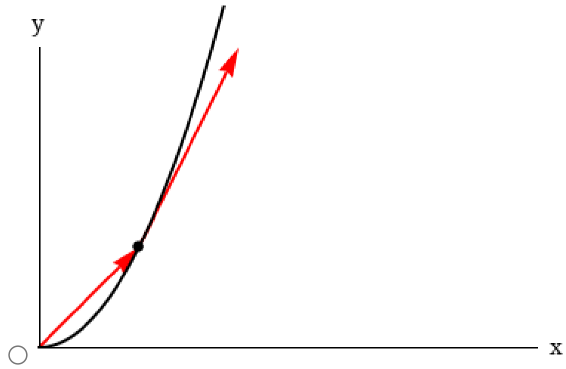
✕ $10e^{10t}\mathbf{i} + 5e^{5t}\mathbf{j}$

(b) Sketch the plane curve together with position vector $\mathbf{r}(t)$ and the tangent vector $\mathbf{r}'(t)$ for the given value of $t = 0$.







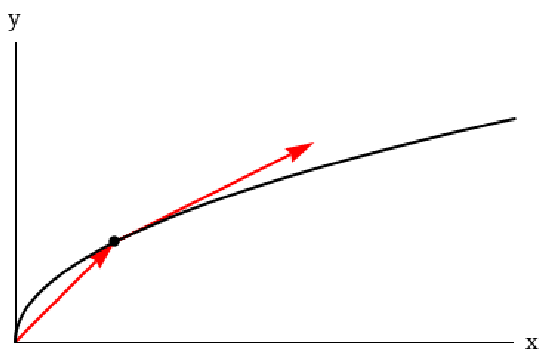


✕

Solution or Explanation

Since $x = e^{10t} = (e^{5t})^2 = y^2$, the curve is part of a parabola. Note that here $x > 0$, $y > 0$.

$\mathbf{r}'(t) = 10e^{10t}\,\mathbf{i} + 5e^{5t}\,\mathbf{j}$



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15. [– / 1 Points] 0/5 Submissions Used

DETAILS

SCalcET9M 13.1.001.

Find the domain of the vector function. (Enter your answer using interval notation.)

$$\mathbf{r}(t) = \left\langle \ln(t + 4), \frac{t}{\sqrt{25 - t^2}}, 2^t \right\rangle$$

✕ $(-4, 5)$

Solution or Explanation

The component functions $\ln(t + 4)$, $\frac{t}{\sqrt{25 - t^2}}$, and 2^t are all defined when $t + 4 > 0 \Rightarrow t > -4$ and $25 - t^2 > 0 \Rightarrow -5 < t < 5$, so the domain of $\mathbf{r}$ is $(-4, 5)$.

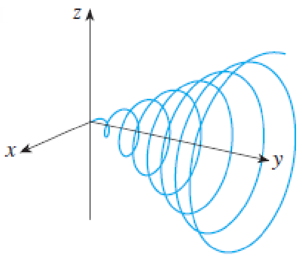
16. [– / 1 Points] 0/5 Submissions Used

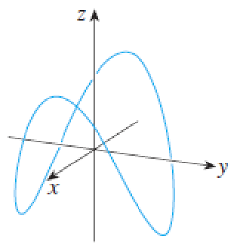
DETAILS

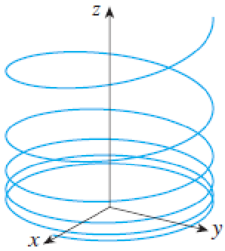
SCalcET9M 13.1.029.

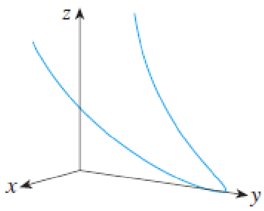
Match the parametric equations with the correct graph.

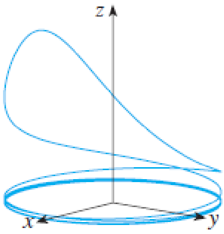
$x = \cos(3t), \quad y = \sin(3t), \quad z = e^{0.3t}, \quad t \ge 0$

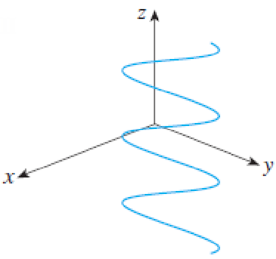






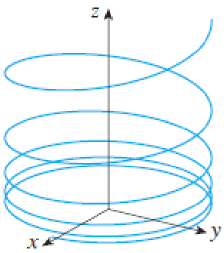






Solution or Explanation

$x = \cos 3t, \quad y = \sin 3t, \quad z = e^{0.3t}, \quad t \ge 0.$ $x^2 + y^2 = \cos^2 3t + \sin^2 3t = 1$, so the curve lies on a circular cylinder with axis the z-axis. A point (x, y, z) on the curve lies directly above the point $(x, y, 0)$, which moves counterclockwise around the unit circle in the xy-plane as t increases. The curve starts at $(1, 0, 1)$, when $t = 0$, and $z \to \infty$ (at an increasing rate) as $t \to \infty$, so the graph is:



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