1. [–/13 Points] DETAILS SCALC8 13.1.050.

Two particles travel along the space curves

$$\mathbf{r}_1(t) = \langle t, t^2, t^3 \rangle \qquad \mathbf{r}_2(t) = \langle 1 + 6t, 1 + 30t, 1 + 126t \rangle.$$

Find the points at which their paths intersect. (If an answer does not exist, enter DNE.)

$(x, y, z) = ($ ______ $)$ (smaller x-value)

$(x, y, z) = ($ ______ $)$ (larger x-value)

Find the time(s) when the particles collide. (Enter your answers as a comma-separated list. If an answer does not exist, enter DNE.)

$t =$ ______

Need Help? Read It

Show My Work (Required)

What steps or reasoning did you use? Your work counts towards your score.

2. [–/1 Points] DETAILS SCALC8 13.1.505.XP.

Find the limit.

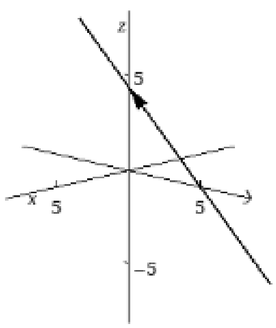
$$\lim_{t \to \infty} \left\langle \arctan(7t), e^{-8t}, \frac{\ln(t)}{t} \right\rangle$$

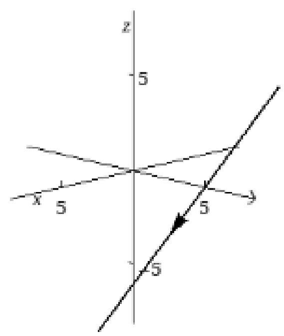
______

3. [–/1 Points] DETAILS SCALC8 13.1.009.

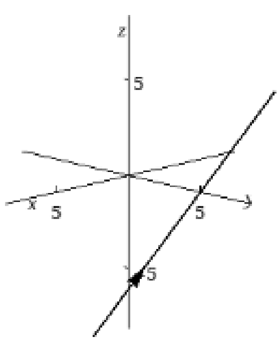
Sketch the curve with the given vector equation. Indicate with an arrow the direction in which t increases.

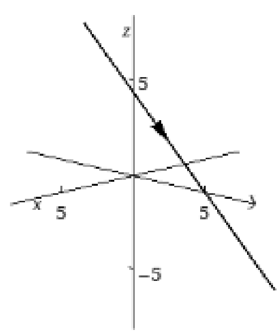
$$\mathbf{r}(t) = \langle t, 5 - t, 2t \rangle$$





○ ○





○ ○

4. [–/1 Points] DETAILS **SCALC8 13.1.019.**

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

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

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

parametric equations $(x(t), y(t), z(t)) = \left(\text{______}\right)$

5. [–/1 Points] DETAILS **SCALC8 13.1.044.**

Find a vector function, $\mathbf{r}(t)$, that represents the curve of intersection of the two surfaces.

The paraboloid $z = 5x^2 + y^2$ and the parabolic cylinder $y = 3x^2$

$\mathbf{r}(t) =$ ______

6. [–/4 Points] DETAILS **SCALC8 13.2.021.**

If $\mathbf{r}(t) = \langle 6t, 5t^2, 5t^3 \rangle$, find $\mathbf{r}'(t)$, $\mathbf{T}(1)$, $\mathbf{r}''(t)$, and $\mathbf{r}'(t) \times \mathbf{r}''(t)$.

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

$\mathbf{T}(1) =$ ______

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

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

7. [–/1 Points] DETAILS **SCALC8 13.2.502.XP.**

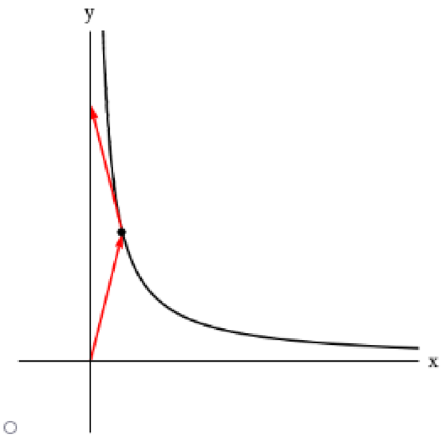
Consider the given vector equation.

$\mathbf{r}(t) = 4e^{t}\mathbf{i} + 5e^{-t}\mathbf{j}$

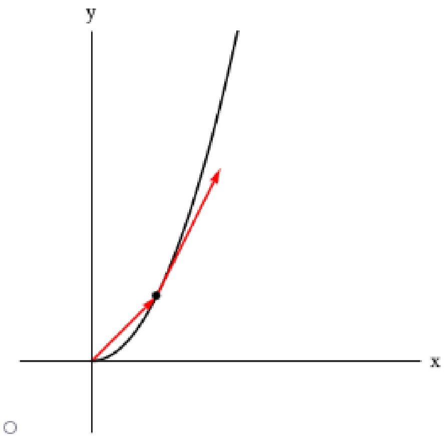
(a) Find $\mathbf{r}'(t)$.

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

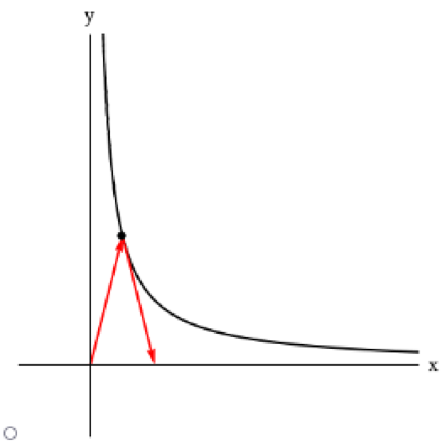
(b) Sketch the plane curve together with the position vector $\mathbf{r}(t)$ and the tangent vector $\mathbf{r}'(t)$ for the given value of $t = 0$.



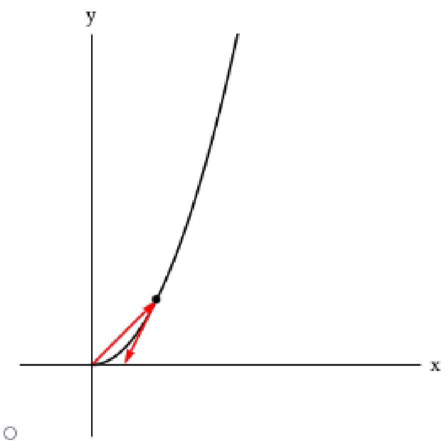
○



○



○



○

8. [–/1 Points] DETAILS **SCALC8 13.2.505.XP.**

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

$$\mathbf{r}(t) = e^{t^2}\mathbf{i} - \mathbf{j} + \ln(1 + 2t)\mathbf{k}$$

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

9. [–/1 Points] DETAILS **SCALC8 13.2.509.XP.**

Find parametric equations for the tangent line to the curve with the given parametric equations at the specified point.

$$x = 4e^{t}, y = te^{2t}, z = te^{t^5}; (4, 0, 0)$$

$x(t), y(t), z(t) =$ [ ]

10. [–/1 Points] DETAILS **SCALC8 13.2.511.XP.**

Evaluate the integral.

$$\int_0^{\pi/2} \left(3 \sin^2(t) \cos(t)\,\mathbf{i} + 4 \sin(t) \cos^3(t)\,\mathbf{j} + 4 \sin(t) \cos(t)\,\mathbf{k}\right) dt$$

11. [–/13 Points] DETAILS **SCALC8 13.3.017.MI.**

Consider the vector function given below.

$\mathbf{r}(t) = \langle 8t, 5 \cos(t), 5 \sin(t) \rangle$

(a) Find the unit tangent and unit normal vectors $\mathbf{T}(t)$ and $\mathbf{N}(t)$.

$\mathbf{T}(t) =$

$\mathbf{N}(t) =$

(b) Use this formula to find the curvature.

$\kappa(t) =$

Need Help? Read It Watch It Master It

Show My Work (Required)

What steps or reasoning did you use? Your work counts towards your score.

12. [–/1 Points] DETAILS **SCALC8 13.3.501.XP.**

Find the length of the curve.

$\mathbf{r}(t) = 9t\,\mathbf{i} + 12t^{3/2}\,\mathbf{j} + 9t^2\,\mathbf{k}, \quad 0 \le t \le 1$

13. [–/1 Points] DETAILS **SCALC8 13.3.025.**

Find the curvature of $\mathbf{r}(t) = \langle 5t, t^2, t^3 \rangle$ at the point $(5, 1, 1)$.

$\kappa =$

14. [–/1 Points] DETAILS **SCALC8 13.3.053.**

At what point on the curve $x = t^3, y = 12t, z = t^4$ is the normal plane parallel to the plane $6x + 24y - 8z = 1$?

$(x, y, z) = (\quad)$

15. [–/1 Points] DETAILS **SCALC8 13.4.010.**

Find the velocity, acceleration, and speed of a particle with the given position function.

$\mathbf{r}(t) = \langle 3 \cos(t), 6t, 3 \sin(t) \rangle$

$\mathbf{v}(t) =$

$\mathbf{a}(t) =$

$|\mathbf{v}(t)| =$

16. [–/1 Points] DETAILS SCALC8 13.4.503.XP.

A gun is fired with angle of elevation 30°. What is the muzzle speed if the maximum height of the shell is 486 m? (Round your answer to the nearest whole number. Use $g \approx 9.8$ m/s^2.)

v_0 = ______ m/s

17. [–/1 Points] DETAILS SCALC8 13.4.034.

Water traveling along a straight portion of a river normally flows fastest in the middle, and the speed slows to almost zero at the banks. Consider a long straight stretch of river flowing north, with parallel banks 40 m apart. If the maximum water speed is 3 m/s, we can use the sine function,

$f(x) = 3 \sin(\pi x/40)$,

as a basic model for the rate of water flow x units from the west bank. Suppose a boater would like to pilot the boat to land at the point B on the east bank directly opposite point A. If the boat maintains a constant heading and a constant speed of 5 m/s, determine the angle at which the boat should head. (Round your answer to one decimal place.)

Answer: ___________ degrees south of east

18. [–/1 Points] DETAILS SCALC8 13.4.020.

What force is required so that a particle of mass m has the position function $\mathbf{r}(t) = t^3\mathbf{i} + 7t^2\mathbf{j} + t^3\mathbf{k}$?

$\mathbf{F}(t)$ = ______