



MATH 151- WEEK-IN-REVIEW 6

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MORE DERIVATIVES

1. Differentiate the following functions. You don't need to simplify.

(a) $r(x) = \arctan(3x^2 - 1)$

(b) $r(x) = \arcsin(x^3 e^x)$

(c) $f(t) = \ln(4t - 6t^2)$

(d) $g(x) = \cos(\log_4(x))$



(e) $y = (\ln(3x))^{\csc(x)}$

(f) $g(x) = \frac{(4x + 1)^5(6 - 5x)^2}{2x^9 e^{4x^2 + 7x}}$

2. Find an equation of tangent line to the curve $y = 5x^3 \ln(x)$ at the point $(1, 0)$.



3. Given $\mathbf{r}(t) = \langle 2 \sin(t) + 2 \cos(t), 3 \cos(t) - 3 \sin(t) \rangle$

(a) Find $\mathbf{r}'\left(\frac{2\pi}{3}\right)$.

(b) Write the equation of the tangent line at $t = 0$.

(c) Find the horizontal tangent line(s) for $\mathbf{r}(t)$.

(d) Find the vertical tangent line(s) for $\mathbf{r}(t)$.



4. Given $\mathbf{r}(t) = \langle t^4 - 24t + 5, 10t^5 + 1 \rangle$
(a) Find $\mathbf{r}'(1)$.

(b) Write the equation of the tangent line at $t = 0$.

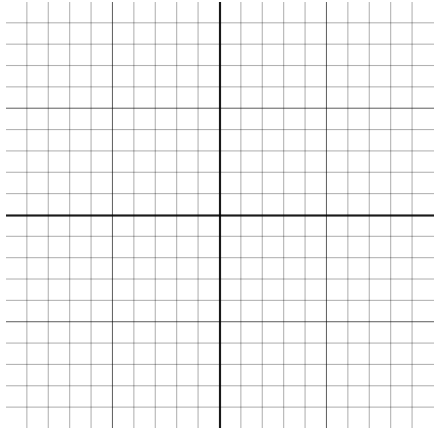
(c) Find the horizontal tangent line(s) for $\mathbf{r}(t)$.

(d) Find the vertical tangent line(s) for $\mathbf{r}(t)$.

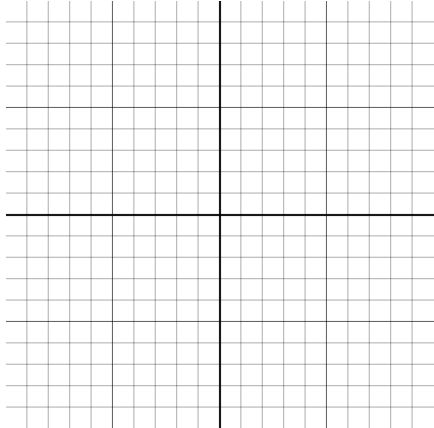


5. Sketch the curve with the given vector equation. Indicate with an arrow the direction in which t increases.

(a) $\mathbf{r}(t) = \langle 2t, t^3 + 1 \rangle$ Include a velocity and acceleration vector for $t = 0$



(b) $\mathbf{r}(t) = \langle \sin(2t), \cos(2t) \rangle$ Include a velocity and acceleration vector for $t = 0$





6. At what point(s) on the curve $x = t^3 - 3t^2 - 12t$, $y = \frac{1}{2}t^2 - t$ is the tangent line parallel to the line with equations $x = 4t$, $y = 1 - 6t$?
7. Find the angle between the velocity vector and the acceleration vector for $\mathbf{r}(t) = \langle t, 2t^3 \rangle$ at the point where $t = 1$.
8. A ball is thrown vertically upward with a velocity of 32 feet per second. The height after t seconds is given by $h(t) = 32t - 16t^2$. With what velocity does the ball hit the ground?



9. A particle moves according to the equation of motion $s(t) = 2t^3 - 6t^2 - 5$, where $s(t)$ is measured in meters and t in seconds.

(a) When is the particle at rest?

(b) What is the acceleration when the particle is at rest?

(c) What is the total distance traveled in the first 3 seconds?

(d) What is the total displacement in the first 3 seconds?



10. During lab, I forgot to measure how much bacteria I started with, but after one hour there were 1000 bacteria. After five total hours, the number of bacteria has increased to 3500 bacteria. Find a formula for the number of bacteria after t hours. Find the number of bacteria and the rate of growth of the bacteria after 2 hours.
11. A particular drug has half life of 15 hours. If we begin with a sample size of mass 500 mg, how long will it take for this sample to decay to a mass of 125 mg?
12. A pie is taken from an oven where the temperature has reached 375°F and is placed on a counter in a room where the temperature is 75°F . If the temperature of the pie is 175°F after 30 minutes, when will the pie have cooled to 90°F ?