

Remember to review homework exercises and the summaries after Chapters 2 and 3.

1. Calculate the following derivatives.

(a) $\frac{d}{dx}(((x+1)^2 + 2)^2 + 3)^2$ (b) $\frac{d}{dt} \sin^2(t^2)$ (c) $\frac{d}{dx} \cos(3e^{2x})$

2. Consider the equation $(x + 3y)^2 + x^2y = 3xy^3 + 14$.

(a) Find dy/dx .

(b) Find the line tangent to the graph of the equation at the point $Q = (1, 1)$.

3. Suppose that the function f is one-to-one on the interval $[-4, 4]$, that $f(1) = 3$, $f(3) = 1$, $f'(1) = 2$, and $f'(3) = 5$. Let g be the inverse of f . Find $g'(3)$.

4. Determine the cosine of the angle between the following pairs of vectors, and indicate whether or not the vectors are perpendicular.

(a) $\mathbf{a} = \langle 3, -1 \rangle$, $\mathbf{b} = \langle -2, 2 \rangle$

(b) $\mathbf{a} = \langle -1, 2 \rangle$, $\mathbf{b} = \langle 4\pi, 2\pi \rangle$

(c) $\mathbf{a} = \langle 1, -1 \rangle$, $\mathbf{b} = \langle 3, 4 \rangle$

5. The position vector $\mathbf{r}(t)$ of a soccer player is observed at several times:

$\mathbf{r}(1) = \langle 0, 10 \rangle$, $\mathbf{r}(2.5) = \langle 3, 12 \rangle$, $\mathbf{r}(3) = \langle 7, 13 \rangle$, $\mathbf{r}(5) = \langle 9, 15 \rangle$, where the times are in seconds, and the position coordinates are in meters. Find the player's average velocity and average speed between times 3 and 5 seconds.

6. A watermelon is launched by slingshot across a flat, level parking lot. At time $t = 0$, it's (horizontal, vertical) position is $\mathbf{r}_0 = \langle 0, 1 \rangle$. The initial velocity is $\mathbf{v}_0 = \langle 2\sqrt{3}, 2 \rangle$. Assuming units of meters and seconds, with acceleration due to gravity of $-9.8\mathbf{j}$ m/s, find the trajectory of the watermelon and the time of impact with the pavement. Neglect air resistance and watermelon size.

7. Suppose an object moves counterclockwise with constant speed around a circle of radius 2, centered at the origin. If at some time t_0 , the velocity is $\mathbf{v}(t_0) = \langle 4, 4 \rangle$, what is the position of the object?