

Math 203, Fall 2025 — Homework 3

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Due September 26

Instructions. This problem set contains problems from Week 3 of class. The problem numbers refer to the PDF version of our textbook, *Apex Calculus*, by Gregory Hartman.

Problem 1. Please do the following textbook problems:

- Section 10.6: 8, 10, 12, 14, 18, 20, 24
- Section 11.2: 21, 22, 23, 42, 44

Problem 2. Create a vector-valued function whose graph matches the given description.

- a. A circle of radius 3, centered at $(-6, 7)$ traced counter-clockwise for $0 \leq t \leq 2\pi$.
- b. A circle of radius 2, centered at $(1, 4)$ traced clockwise for $0 \leq t \leq 2\pi$.

Problem 3. Create a vector-valued function whose graph matches the given description.

- a. A line through the points $P = (7, 8, 9)$ and $Q = (11, 12, 10)$ with $\mathbf{r}(0) = P, \mathbf{r}(3) = Q$.
- b. A line through the points $P = (1, 3, 5)$ and $Q = (2, 4, 6)$ with $\mathbf{r}(0) = Q, \mathbf{r}(5) = P$.

Problem 4. Sketch the curve traced by each vector-valued function for values of t on the interval $-2 \leq t \leq 2$. Make sure to indicate the direction of motion along the curve.

a. $\mathbf{r}(t) = \langle t, t^2 + 2 \rangle$

b. $\mathbf{r}(t) = \langle t^2 + 1, t \rangle$

c. $\mathbf{r}(t) = \langle e^t, e^t \rangle$ (hint: how are the x and y components related?)

Problem 5. Compute the derivatives of the following functions.

a. $\mathbf{r}(t) = \langle \cos(4t), \sin(t^2), e^{t^3+5} \rangle$

b. $\mathbf{r}(t) = \langle (t^3 + t^2)e^t, t^4 \sin t, t^5 \cos t \rangle$

c. $\mathbf{r}(t) = \left\langle \frac{t^2+t}{t^4+t^3}, \frac{\sin t}{t^4+1}, \frac{e^t}{t^2+t} \right\rangle$

Problem 6. If you liked the problems above or want more practice, our textbook has more great problems. Many odd-numbered ones have solutions in the back. Here are some that I recommend (as optional, not to be turned in):

- Section 10.6: 1, 2, 3, 5, 7, 9, 11, 13, 15, 17, 19, 23, 25
- Section 11.1: 5, 7, 21, 25, , 27, 29
- Section 11.2: 11, 13, 15, 17, 19, 41, 43

Feel free to try others, including the problems in the main sections, which include full explanations.