

You must justify your answers to receive full credit.

- 12.7: Q10, 17, 19
 - 12.7: Q21a, b
 - 12.3: Q16, 17
 - Chapter 12 Review: Q7
 - 13.1: Q2, 3
 - 13.1: Q11
 - 13.1: Q17 (Hint: use the second derivative test.)
1. Find Taylor polynomials of the indicated degree for the given following functions near the given point.
 - a) $f(x, y) = (x^2 - 3y^3)^{3/2}$, second order, about $(2, 1)$;
 - b) $e^{1+x^2+3xy^2} \cos y$, sixth order, about $(0, 0)$;
 - c) $\frac{y^2}{1+x}$, fourth order, about $(0, 0)$;
 - d) $\frac{y^2}{1+x}$, fourth order, about $(-2, 0)$. (Hint: $1+x = -1+x-(-2)$.)
 2. For each of the sets below:
 - i) Find its interior;
 - ii) Find its boundary;
 - iii) Determine whether it is closed;
 - iv) Determine whether it is bounded.
 - a) $\{(x, y) \in \mathbb{R}^2 \mid x + y = 1\}$;
 - b) $\{(x, y) \in \mathbb{R}^2 \mid 0 < x^2 + y^2 < 1\}$;
 - c) $\{(x, y, z) \in \mathbb{R}^3 \mid 0 < x^2 + y^2 < 1\}$;
 - d) $\{(x, y, z) \in \mathbb{R}^3 \mid x^2 + y^2 < 1, y + z \geq 2\}$.
 3. Consider the function $f : \mathbb{R}^2 \rightarrow \mathbb{R}$ given by
$$f(x, y) = e^x + y,$$
and let S be the graph of f .

- a) Find ∇f at $(1, 1)$.
- b) Find a direction normal to S at $(1, 1, e + 1)$.
- c) A marble is placed on S at $(1, 1, e + 1)$. In which direction will it start to roll? (Hint: this is a direction tangent to S at $(1, 1, e + 1)$ that decreases its z -coordinate most quickly.)

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