

You must justify your answers to receive full credit.

- 12.6 Q18, 19. Additional part for Q19: suppose $\mathbf{g}(u, v) = (uv, \sqrt{v})$. Find $D(\mathbf{g} \circ \mathbf{f})(2, 2, 1)$.
 - 12.5 Q1, 2, 6, 17
 - 12.7: Q10, 17, 19
 - 12.7: Q21a, b
 - 12.3: Q16, 17
 - 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) $\frac{\cos(3y + xy)}{1 + x}$, fourth order, about $(0, 0)$;
 - c) $\frac{\cos(3y + xy)}{1 + x}$, fourth order, about $(-2, 0)$.
2. 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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