Put answers on a separate piece of paper. Label each Section. Show all work for Free Response questions.

Quick Quiz for AP* Preparation: Sections 4.1–4.3

You should solve these problems without using a graphing calculator.

1. **Multiple Choice** How many critical points does the function $f(x) = (x - 2)^5 (x + 3)^4$ have?

   (A) One (B) Two (C) Three (D) Five (E) Nine

2. **Multiple Choice** For what value of x does the function $f(x) = (x - 2)(x - 3)^2$ have a relative maximum?

   (A) -3 (B) $-\frac{7}{3}$ (C) $-\frac{5}{2}$ (D) $\frac{7}{3}$ (E) $\frac{5}{2}$

3. **Multiple Choice** If g is a differentiable function such that $g(x) < 0$ for all real numbers x, and if $f'(x) = (x^2 - 9)g(x)$, which of the following is true?

   (A) f has a relative maximum at $x = -3$ and a relative minimum at $x = 3$.

   (B) f has a relative minimum at $x = -3$ and a relative maximum at $x = 3$.

   (C) f has relative minima at $x = -3$ and at $x = 3$.

   (D) f has relative maxima at $x = -3$ and at $x = 3$.

   (E) It cannot be determined if f has any relative extrema.

4. **Free Response** Let f be the function given by $f(x) = 3 \ln (x^2 + 2) - 2x$ with domain $[-2, 4]$.

   (a) Find the coordinate of each relative maximum point and each relative minimum point of f. Justify your answer.

   (b) Find the x-coordinate of each point of inflection of the graph of f.

   (c) Find the absolute maximum value of $f(x)$.

Quick Quiz for AP* Preparation: Sections 4.4–4.6

You may use a graphing calculator to solve the following problems.

1. **Multiple Choice** If Newton's method is used to approximate the real root of $x^3 + 2x - 1 = 0$, what would the third approximation, x_3, be if the first approximation is $x_1 = 1$?

   (A) 0.453 (B) 0.465 (C) 0.495 (D) 0.600 (E) 1.977

2. **Multiple Choice** The sides of a right triangle with legs x and y and hypotenuse z increase in such a way that $dz/dt = 1$ and $dx/dt = 3\, dy/dt$. At the instant when $x = 4$ and $y = 3$, what is dx/dt ?

   (A) $\frac{1}{3}$ (B) 1 (C) 2 (D) $\sqrt{5}$ (E) 5

3. **Multiple Choice** An observer 70 meters south of a railroad crossing watches an eastbound train traveling at 60 meters per second. At how many meters per second is the train moving away from the observer 4 seconds after it passes through the intersection?

   (A) 57.60 (B) 57.88 (C) 59.20 (D) 60.00 (E) 67.40

4. **Free Response** (a) Approximate $\sqrt{26}$ by using the linearization of $y = \sqrt{x}$ at the point (25, 5). Show the computation that leads to your conclusion.

   (b) Approximate $\sqrt{26}$ by using a first guess of 5 and one iteration of Newton's method to approximate the zero of $x^2 - 26$. Show the computation that leads to your conclusion.

   (c) Approximate $\sqrt[3]{26}$ by using an appropriate linearization. Show the computation that leads to your conclusion.

Ch 4 Review Section

AP Examination Preparation

You should solve the following problems without using a calculator.

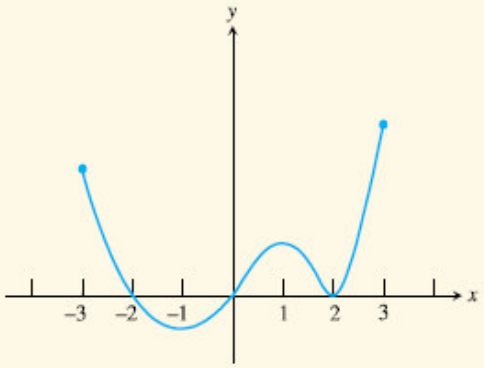
70. The accompanying figure shows the graph of the derivative of a function f. The domain of f is the closed interval $[-3, 3]$.

(a) For what values of x in the open interval $(-3, 3)$ does f have a relative maximum? Justify your answer.

(b) For what values of x in the open interval $(-3, 3)$ does f have a relative minimum? Justify your answer.

(c) For what values of x is the graph of f concave up? Justify your answer.

(d) Suppose $f(-3) = 0$. Sketch a possible graph of f on the domain $[-3, 3]$.



71. The volume V of a cone ($V = \frac{1}{3}\pi r^2 h$) is increasing at the rate of 4π cubic inches per second. At the instant when the radius of the cone is 2 inches, its volume is 8π cubic inches and the radius is increasing at 1/3 inch per second.

(a) At the instant when the radius of the cone is 2 inches, what is the rate of change of the area of its base?

(b) At the instant when the radius of the cone is 2 inches, what is the rate of change of its height h?

(c) At the instant when the radius of the cone is 2 inches, what is the instantaneous rate of change of the area of its base with respect to its height h?

72. A piece of wire 60 inches long is cut into six sections, two of length a and four of length b. Each of the two sections of length a is bent into the form of a circle and the circles are then joined by the four sections of length b to make a frame for a model of a right circular cylinder, as shown in the accompanying figure.

(a) Find the values of a and b that will make the cylinder of maximum volume.

(b) Use differential calculus to justify your answer in part (a).