1. **USING THE DEFINITION OF THE DERIVATIVE ("4 step method"), find $f'(-1)$ when $f(x) = 4x^2 - 7$.**

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2. Suppose P is a function defined by

$$P(x) = \begin{cases} -x^2 + k & \text{when } x \le 1 \\ 3x + 1 & \text{when } x > 1 \end{cases}$$

Find a value for k so that P is continuous at $x = 1$. Show your work. Explain the reasons for your response briefly with a graph and a mapping diagram.

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3. **Suppose P is a function with P(5) = 6 and P(5.1) = 2. Estimate P'(5)** . [Hint: Use the definition.]

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4. Suppose **$Q(x) = x/N(x)$, $N(2)=3$ *and* $N'(2)=5$** . **Find Q'(2).**

5.

a. **Using the intermediate value theorem, explain why $x^5 - 3x + 1 = 0$ has a root between 1 and 2.**

b. **Using $x_1 = 1$, find a better estimate for the solution of $x^5 - 3x + 1 = 0$ with one step of Newton's method.**

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6. Suppose the coordinate of an object moving on a number line at time t seconds is $G(t)$ meters.

a. *Describe in words* the interpretation in this context of the equations: **G(3)=4, G'(3)=5 and G''(3)= -2.**

b. **Assume the equations in part a) are true**. Estimate the coordinate of the object at 3.1 seconds. Draw a mapping diagram to illustrate the situation including your estimate. Based on the assumed information, do you think your estimate will be larger or smaller than the actual value? Explain your response.

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7. **Suppose $f(x) = x^3 + Bx^2 + 2x + A$. Find A and B so that f(0) = 1 and f '(1) = 7.**

8. **Let $P(t) = K + Lt + Mt^2$.**
Find the coefficients K, L, and M so that $P'(t) + P(t) = t^2 + t + 1$ for all t.
Hint: Consider the equation when t = 0, t = 1 and t = -1.

9. **Making Curves Fit together Smoothly.**
One way to make a curve that passes through several points and looks smooth is to draw several curves that are defined by a small number of points and make sure that when the curves are joined together they have the same tangent lines, making the connections appear smooth.

a. **Use curves defined by two quadratic poylnomial functions to make a single smooth curve that passes through the four points, (-1,0), (0,0), (1,-2) and (2,0) as in the figure. Discuss briefly the strategy you used to find your solution. [Hint: Have the pair of curves meet at (0,0).]**

b. **Find a second pair of quadratic polynomials which can be used to make a single smooth curve that passes through the same four points. [Hint: Have the pair of curves meet at (1,-2).]**

c. **Find a single cubic polynomial that passes through the same four points. [Hint: What are the linear factors of such a polynomial?]**