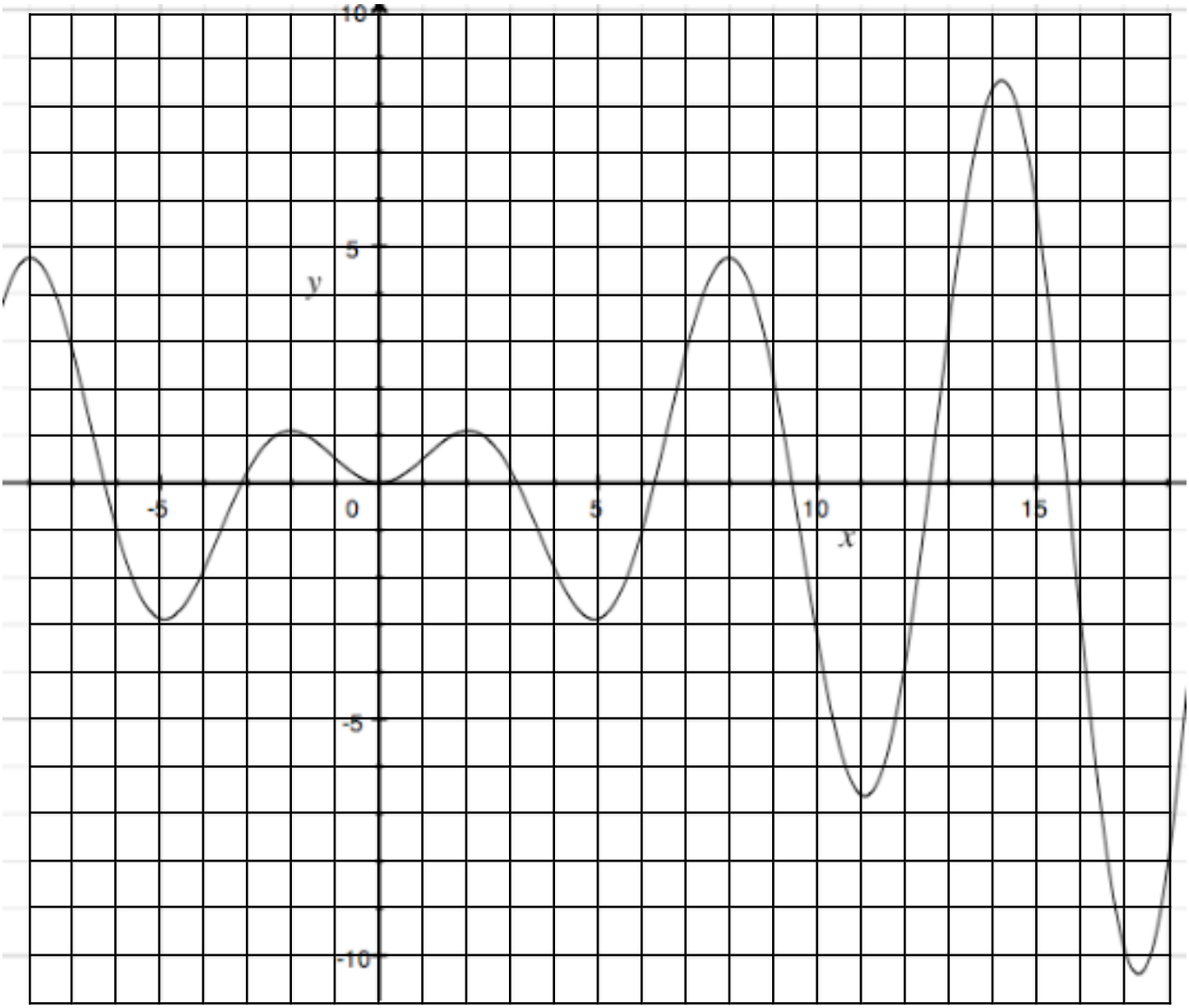
Name: _____ **TC**

Classwork 53

1. a) Label the graph below with **0** where the derivative is zero, **+** where the derivative is positive, and **-** where the derivative is negative.

   b) Label the graph with **M** in places where the slope is at a max (most positive) and **m** where the slope is at a minimum (most negative)

   c) Use your answers to (a) & (b) to sketch a graph of the derivative on the same axes.



2. The graph below shows $y = 1/3x^3 - 3x^2 + 5x - 1$

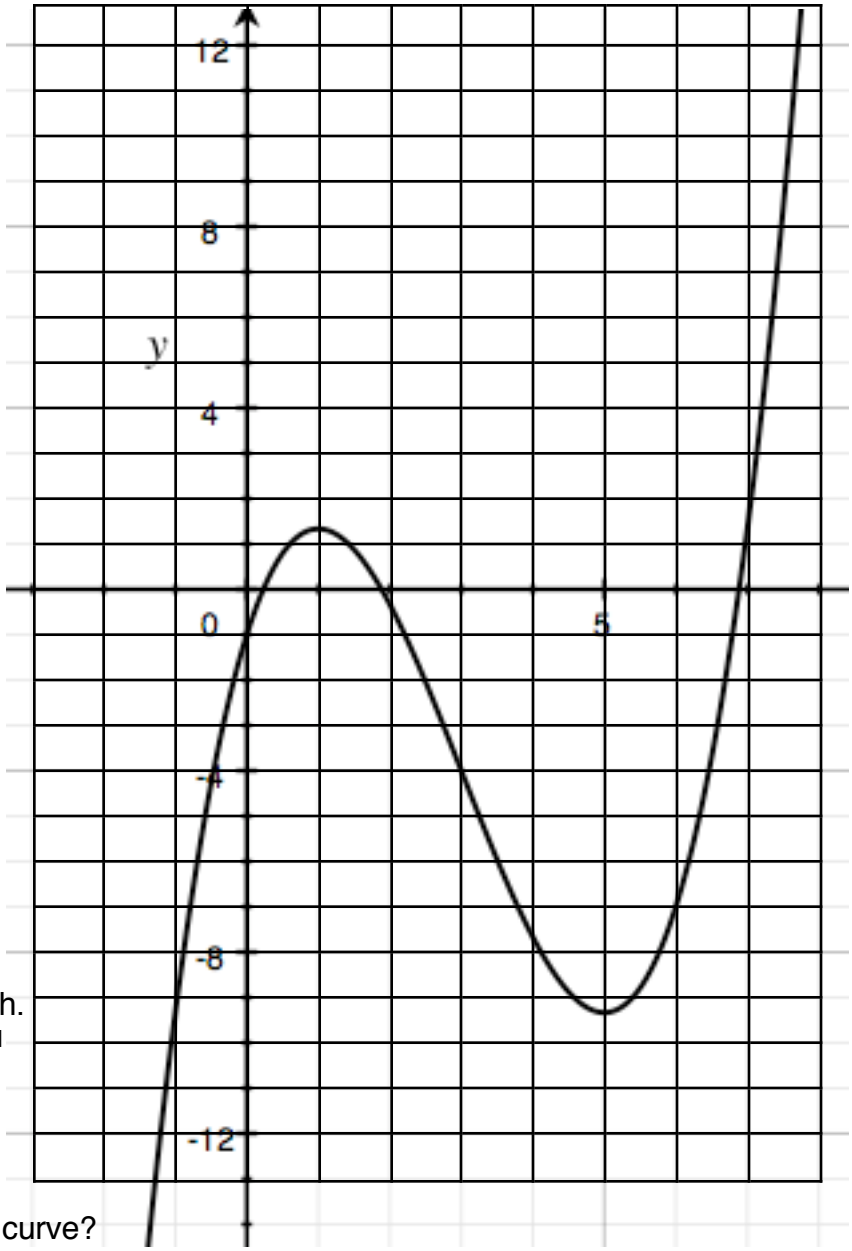
a) When is the derivative of this graph positive? Use the graph to estimate.

b) When is the derivative of this graph negative? Use the graph to estimate.

c) When is the derivative of this graph zero? Use the graph to estimate.

d) What **is** the derivative of this curve?

e) Show that your answers above are correct using the derivative.



f) **Graph** the derivative on this same graph. You should use your calculator to help you get an accurate graph.

g) What is the **second derivative** of this curve?

h) Graph the **second derivative** on the same axes. Use your calculator to get an accurate graph.

i) What does the **second derivative** tell you about the derivative?

about the **original graph???**

3. a) Explain using calculus why a line has no maximum or minimum.

b) Explain using calculus why a line has no curvature.

4. a) Explain using calculus why a parabola always has both regions of positive slope and regions of negative slope.

b) What is the only coefficient that matters in whether a parabola opens upward or downward? (Consider the general form $y = ax^2 + bx + c$)

c) Explain using calculus why a parabola has **either** negative or positive curvature but never both.

5. a) Sketch a graph of the function $y = x^4$

b) Why does the function never dip into negatives?

c) Why is the slope sometimes positive and sometimes negative?

d) Why is the curvature always positive?

6. a) Sketch a graph of the function $y = x^4 - x^2$

   b) When is the function negative?

   c) What are the maxima and minima of the function?

   d) Where does the curvature change?