

Calculus Card Matching

A Game of Matching Functions

Description

Give each group of students a packet of cards. Students work as a group to match the cards, by thinking about their card and what information can be gathered from it.

Objectives

The students will be using their knowledge of calculus to relate functions, their graphs, and their derivatives.

Standards/Benchmarks

Describes, analyzes, and generalizes relationships, patterns, and functions using words, symbols, variables, tables, and graphs.

- State, understand, and apply the definition of derivative.
- Find the slope of a curve at a point, including points at which there are vertical tangents and no tangents.
- Find local and absolute maximum and minimum points.
- Use first and second derivatives to help sketch graphs. Compare the corresponding characteristics of the graphs of f , f' , and f'' .

Relevance

Taking derivatives may be easy for some students, but this activity requires that they think backwards and fully analyze all the aspects of a function and its derivative.

Learning Challenges

This is a higher level calculus problem. Some of the functions are quite complex and will be more of a challenge.

Bodies of Knowledge

- Graph quadratic equations with and without graphing technology.
- Understand the concept of derivative geometrically, numerically, and analytically, and interpret the derivative as an instantaneous rate of change, or as the slope of the tangent line.

Inquiry Questions:

What does the equation order tell me?

Do the number of peaks and troughs make a difference?

Relating a Function and its Derivative

Key to Matching Card Game

Function Graph	Derivative Graph	Function Description	Derivative Description	Equation of f(x) Zoom 4 Decimal Window
F1	D4	f7	d9	$y = -\frac{1}{8}(x+2)^2(x-3)$
F2	D7	f11	d11	$y = \frac{1}{6}x(x^2-12)$
F3	D11	f1	d7	$y = -\frac{1}{8}x^4 + x^2$
F4	D9	f12	d5	$y = \frac{3}{4}(x^2-4)$
F5	D2	f9	d6	$y = -x^2 + 2x$
F6	D8	f4	d12	$y = x $
F7	D3	f2	d10	$y = 0.08x(x^2-2)(x^2-9)$
F8	D10	f5	d3	$y = -\frac{9}{5}x + \frac{3}{2}$
F9	D1	f6	d4	$y = 0.2\left(\frac{1}{4}x^4 - \frac{2}{3}x^3 - \frac{5}{2}x^2 + 6x\right) + 1$
F10	D5	f8	d2	$y = \frac{3}{0.5x^2 + 1}$
F11	D12	f10	d8	$y = 0.2(x-1)^3 + 1$
F12	D6	f3	d1	$y = \frac{1}{75}x^3(x^2-16)$

DESCRIPTION OF DERIVATIVE

The graph of this derivative is not positive for all x in $[-3, 3]$, and is symmetric to the y -axis.

d1**DESCRIPTION OF DERIVATIVE**

The graph of this derivative is positive when $x < 0$ and is negative when $x > 0$.

d2**DESCRIPTION OF DERIVATIVE**

The graph of the derivative is negative and constant for all x .

d3**DESCRIPTION OF DERIVATIVE**

The graph of this derivative is a cubic polynomial with a positive leading coefficient.

d4**DESCRIPTION OF DERIVATIVE**

This derivative graph is a line that has a positive slope.

d5**DESCRIPTION OF DERIVATIVE**

The slope of this graph is always equal to -2 .

d6**DESCRIPTION OF DERIVATIVE**

The derivative is positive when $x < -2$ and when $0 < x < 2$, and is negative everywhere else.

d7**DESCRIPTION OF DERIVATIVE**

The derivative is always greater than or equal to zero.

d8**DESCRIPTION OF DERIVATIVE**

This derivative has the general form $y = ax^2 + bx + c$, $a < 0$.

d9**DESCRIPTION OF DERIVATIVE**

This derivative graph is an even function with a local maximum at $x = 0$.

d10

DESCRIPTION OF DERIVATIVE

This graph of the derivative is positive when $|x| > 2$.

d11

DESCRIPTION OF DERIVATIVE

The graph of this derivative is undefined when $x = 0$, but is constant for $x < 0$ and for $x > 0$.

d12

DESCRIPTION OF FUNCTION

The function has local maxima at $x = -2$ and $x = 2$.

f1

DESCRIPTION OF FUNCTION

This function has four critical points.

f2

DESCRIPTION OF FUNCTION

This odd function has a triple root at $x = 0$, as well as roots at $x = 4$ and $x = -4$.

f3

DESCRIPTION OF FUNCTION

This is the graph of an absolute value function.

f4

DESCRIPTION OF FUNCTION

This is the graph of a linear function.

f5

DESCRIPTION OF FUNCTION

This function has critical points at $x = -2$, $x = 1$, and $x = 3$.

f6

DESCRIPTION OF FUNCTION

On this graph, $x = -2$ is both a root of the function and a critical point.

f7

DESCRIPTION OF FUNCTION

This function has a horizontal asymptote at $y = 0$.

f8

DESCRIPTION OF FUNCTION

This is the graph of a quadratic function with a negative leading coefficient.

f9

DESCRIPTION OF FUNCTION

This function never decreases.

f10

DESCRIPTION OF FUNCTION

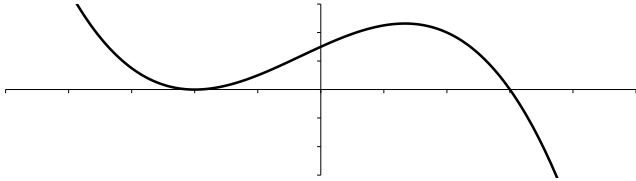
This function has a point of inflection at $x = 0$.

f11

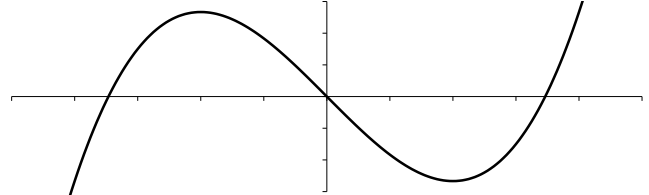
DESCRIPTION OF FUNCTION

This even function is decreasing when $x < 0$, and increasing when $x > 0$.

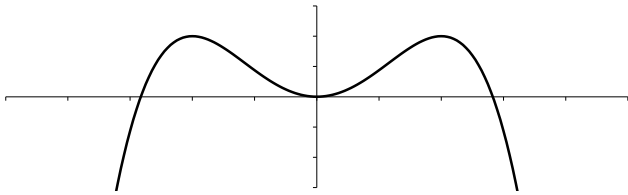
f12



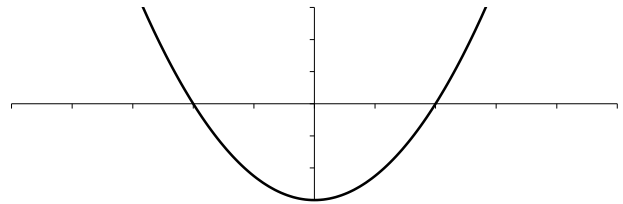
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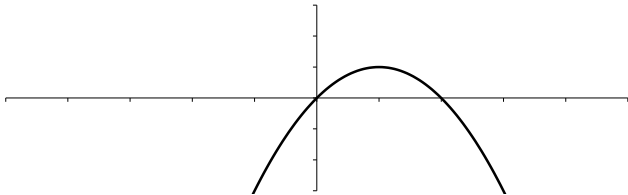
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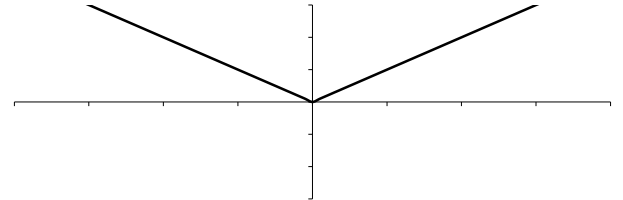
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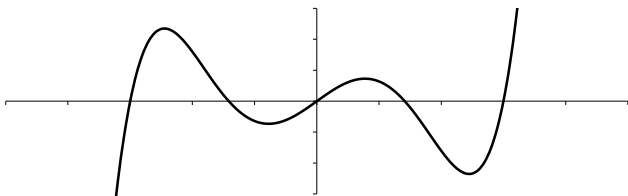
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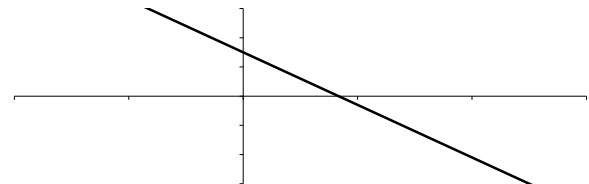
F5



F6

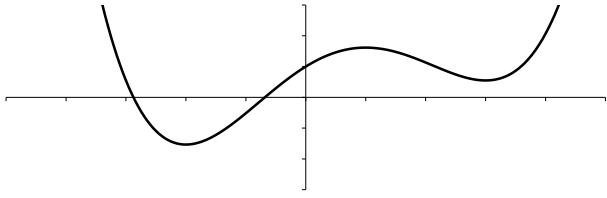


F7

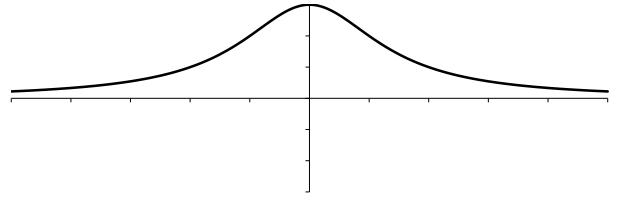


F8

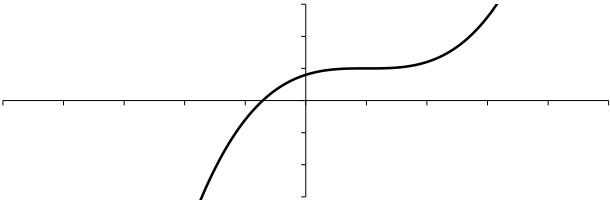
Calculus Card Matching



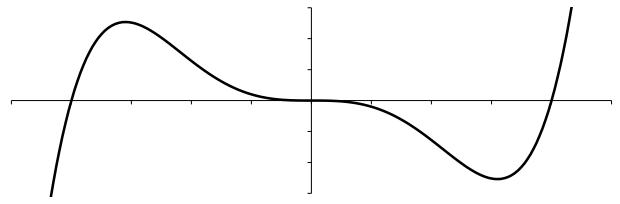
F9



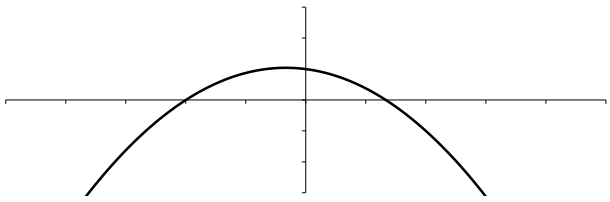
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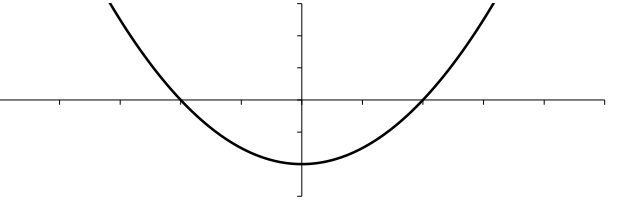
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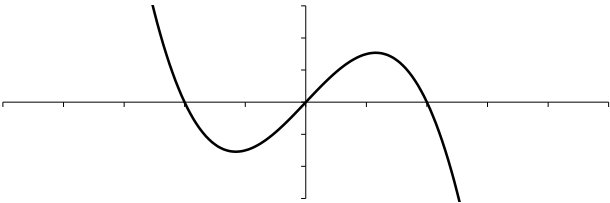
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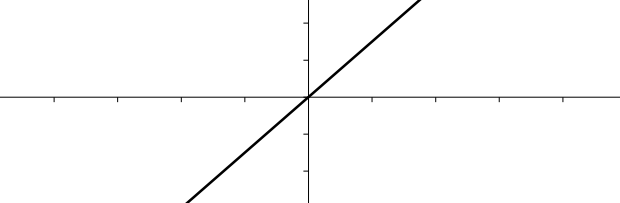
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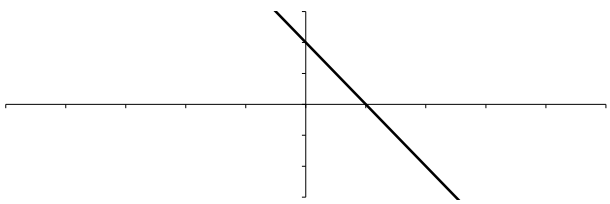
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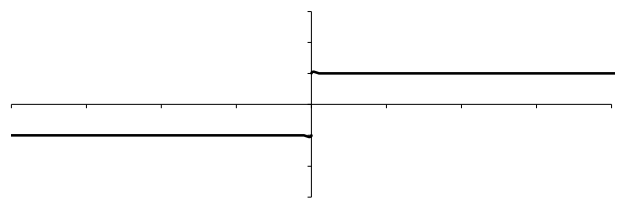
D11



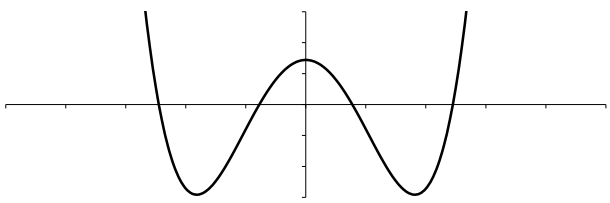
D9



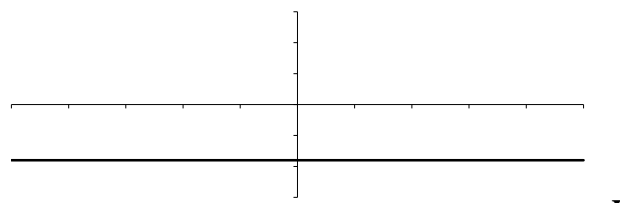
D2



D8



D3



D10

