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Algebra 2H: Polynomial functions and transformations

(A)

Remember: The goal of this test is to enable you to demonstrate your knowledge of the material.

1. The test has 6 questions, plus one extra-credit question.
2. Total points available are 40, plus 2 for extra credit.
3. You have 50 minutes (one block) to complete the test (more if you have accommodations).

Common test instructions:

4. You should **SHOW YOUR WORK** for all parts of the answer in order to receive full credit.
5. Write your answers using either Blue or Black ink or a pencil. Please don't use red pen.
6. Clearly indicate (underline/ box/highlight) your final answer. Mark only **ONE** answer per question.

Special note:

7. You need to finish all aspects of the test **BEFORE** 4pm, Friday, March-31st.

If any of the above is problematic for you, please let me know **BEFORE** Wednesday, March 29th.

The use of a graphing calculator is **NOT** allowed.
A simple 4-operations calculator is allowed.

Good luck!!
Dr. Baharav

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Question 1 (10 pts)

Given the expression:

$$4x^2(x - 1) - x^5 - x^4 + 5x - 3$$

- a) Write the polynomial in standard form P(x)= _____
- b) How many terms are there in P(x)? _____
- c) What is the degree of the polynomial? _____
- d) What is the sign of the leading coefficient? _____
- e) What is the end behavior of the graph? _____
- f) It is given that the polynomial has a root at $x = 1$, and another root at $x = i$. Find all the roots of the polynomial.

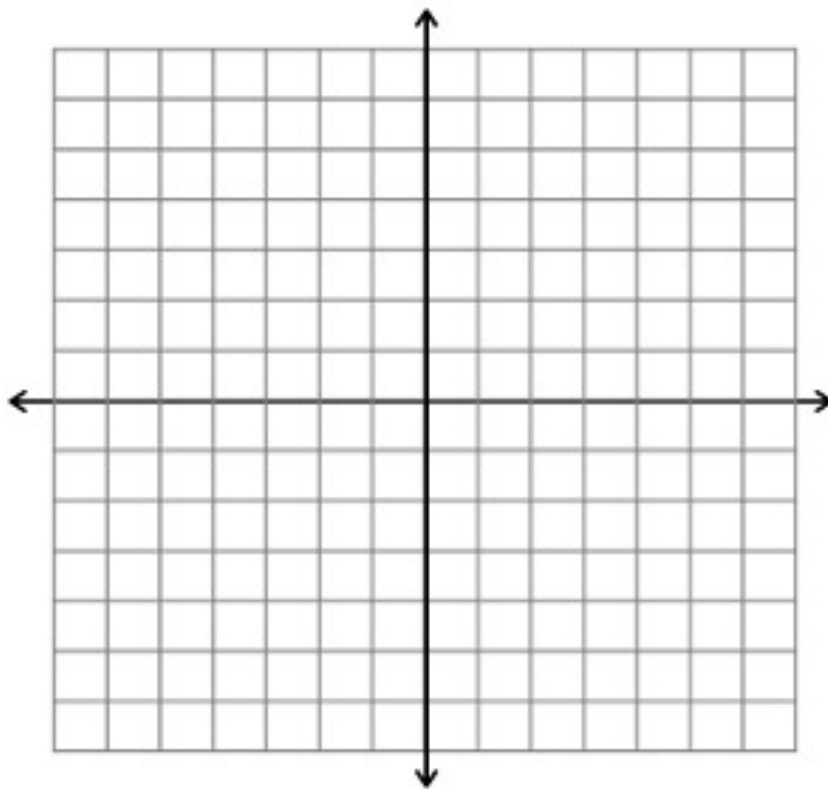
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g) Write the polynomial in a factored form.

h) What is the y-intercept of the polynomial?

i) Utilizing all the information gathered above (and only this information), plot $P(x)$ in the graph below.



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Question 2 (6 pts)

a) Given the polynomial

$$P(x) = x^3 + 3x^2 - 3x - 9$$

I. Find all possible rational roots

II. Find the roots of the polynomial

b) Given the polynomial

$$P(x) = 2x^6 + 4x^5 - 3x^4 + 7x^3 - 2$$

I. Determine the number of possible positive real roots

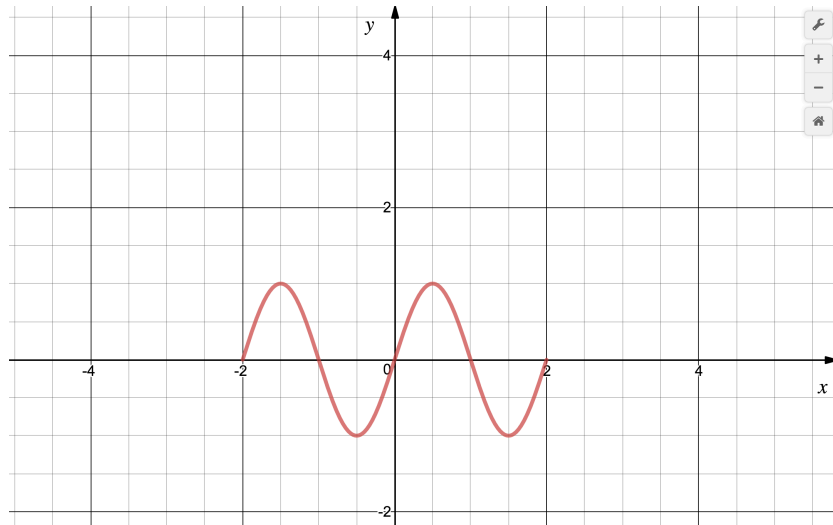
II. Determine the number of possible negative real roots

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Question 3 (6 pts)

The function $f(x)$ is given in the graph below.



In some of the questions below you are asked to plot different functions on the same set of axes. Please indicate clearly which line corresponds to which item.

- a. $f(x)$ as given in the graph. Find the domain and range of the function:

Domain: _____ Range: _____

- b. Is $f(x)$ an even function, odd function, or neither? Explain.

Even / Odd / Neither . Explain: _____

- c. Plot $f(x) + 2$

Domain: _____ Range: _____

- d. Plot $f(x + 2)$

Domain: _____ Range: _____

- e. Plot $f(x/2) - 1$

Domain: _____ Range: _____

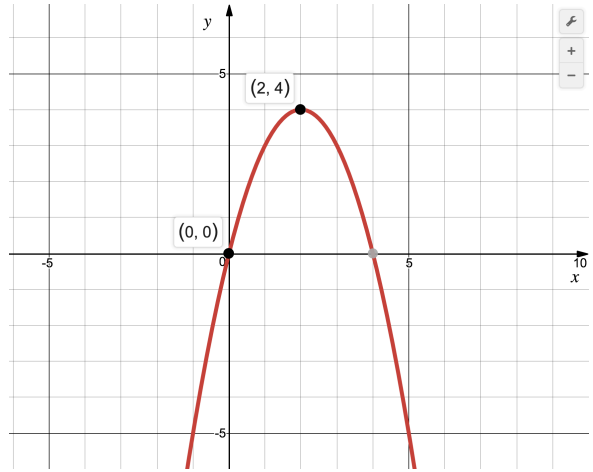
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Question 4 (6 pts)

a) The below function (see graph) is the result of applying transformations to a parabola $y = x^2$.

- I. What is the x-shift? _____
- II. What is the y-shift? _____
- III. Find the equation of $f(x)$ describing the graph.



IV. What are the zeros of $f(x)$? Find these algebraically, not by graph.

b) We construct a new function, $f\left(\frac{x}{m}\right)$, where 'm' is a number and $f(x)$ is the function in part (a). The zeros of the new function are at (0,0) and (12,0).

- I. What is the value of 'm'? Justify your answer.
- II. Write explicitly the function $f\left(\frac{x}{m}\right)$, based on the value of 'm' you found and the expression you found for $f(x)$.
- III. What is the y-intercept of the new function?

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Question 5 (6 pts)

a) Line equation:

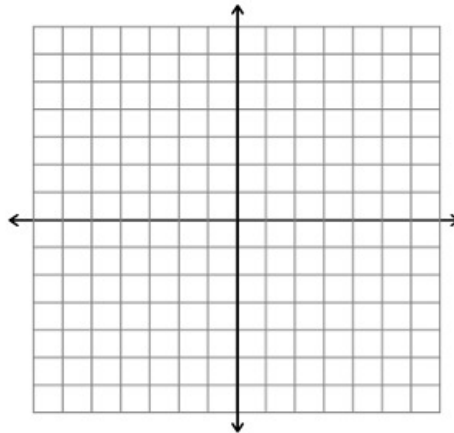
I. Find the equation of the line perpendicular to the line

$$y = \frac{x}{2} - 5,$$

and that includes the point (0,0).

II. What is the two lines' intersection point? Find it algebraically.

III. Plot the two lines on the graph below.



b) Given the below quadratic function

$$f(x) = 5 - 2x + x^2$$

I. Write the quadratic expression in a standard form:

II. Write the function in vertex form:

III. Write the function in factored form:

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Question 6 (6 pts)

The sum of two numbers is 10.

We define P as the product of two terms:

1. The first number
2. The first number minus the second number.

Find the two numbers such that P is minimum.

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Extra Credit : Question 7 (2 pts)

$P(x)$ is a polynomial of degree 4 with a leading coefficient of 5.

$Q(x)$ is a polynomial of degree 7 with a leading coefficient of -3.

We define two new polynomials: $G(x)$ and $M(x)$.

$$G(x) = P(x) \cdot Q(x)$$

$$M(x) = P(x) + Q(x)$$

I. How many roots does $G(x)$ have? Explain.

II. What is the end behavior of $G(x)$? Explain.

III. How many roots does $M(x)$ have? Explain.

IV. What is the end behavior of $M(x)$? Explain.

=== End of test