

The semester A examination for Honors Algebra 2 will consist of two parts. Part 1 will be selected response on which a calculator will not be allowed. Part 2 will be short answer on which a calculator will be allowed.

The following symbol applies to this review:



Indicates that a student should be prepared to complete a question like this with or without a calculator.

- If a calculator is used to find points on a graph, the appropriate calculator function (i.e. zero, intersect, minimum or maximum) should be used. The trace function should not be used.
- Decimal approximations must be accurate to three places after the decimal point.
- Unless otherwise specified, the domain of any function f is assumed to be the set of all real numbers x for which $f(x)$ is a real number.
- $[x]$ represents the greatest integer function.

No formulas will be provided in the examination booklet.

For questions 1 through 8, use the following functions:

$$f(x) = x - 3$$

$$g(x) = 2x - 8$$

$$h(x) = x^2 - 2$$

Evaluate.



1. $f(g(3))$



2. $h(f(-7))$

Perform the following operations.



3. $f(x) + g(x)$



4. $f(x) - g(x)$



5. $f(x) \cdot g(x)$



6. $\frac{f(x)}{g(x)}$ What is the domain of the function $\frac{f(x)}{g(x)}$?



7. $g(h(x))$



8. $h(f(x))$



9. If $f(x) = \sqrt{x+8}$ and $g(x) = 4x$,
- What is the domain of $f(g(x))$?
 - What is the domain of $g(f(x))$?

For questions 10 through 13, state whether the function is one to one.

10. $f(x) = 2x - 5$

11. $f(x) = -x^2$

12. $f(x) = |x|$

13. $f(x) = x^3 - 9x$



14. Sketch the graph of $f(x) = \begin{cases} x+1, & \text{if } x < 0 \\ 3-4x, & \text{if } x \geq 0 \end{cases}$

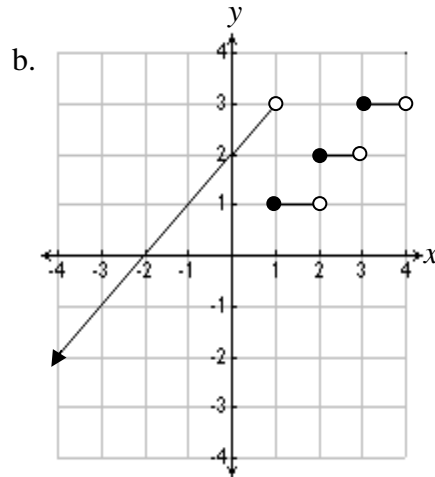
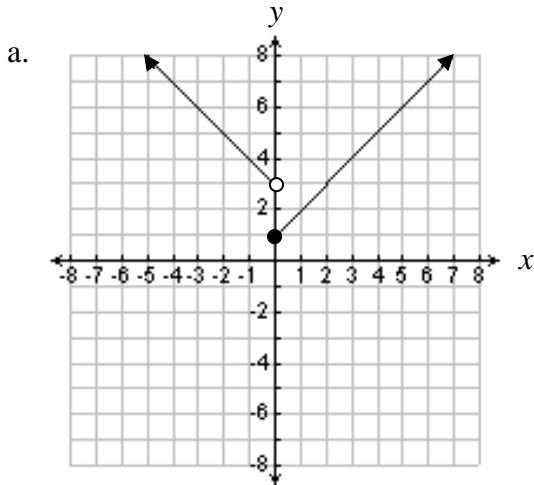


15. Let $f(x) = 3|x+2| - 4$
- Sketch the graph of $f(x)$
 - What is the domain of $f(x)$?
 - What is the range of $f(x)$?
 - What is the vertex of the graph of $f(x)$?
 - What is the axis of symmetry of the graph of $f(x)$?
 - What is the minimum value of $f(x)$?
 - Is the function $f(x)$ continuous?

16. When ordering items from a catalog, the buyer has the option of having items gift-wrapped. The shipping charge for every order is \$12. In addition, if 5 items or less are wrapped, the charge is \$5.00 per item wrapped. If more than 5 items and less than 10 items are wrapped, the charge is \$4.50 per item wrapped. If 10 items or more are wrapped, the charge is \$3.00 per item wrapped.
- Write a piece-wise function for the total charge of gift-wrapping x items, including the shipping charge.
 - If the total charge, plus shipping is exactly \$51, how many items were wrapped?



17. Write the functions represented by the graphs below.



18. Let $f(x) = |x - 2|$. Describe the transformations of $f(x)$ that will produce the graphs of the following functions.

- $g(x) = |x| + 1$
- $h(x) = 5|x - 3| - 9$



19. Are $f(x) = 7x - 6$ and $g(x) = \frac{x + 6}{7}$ inverse functions? Verify your answer algebraically.



20. If $f(x) = \frac{1}{3}x + 5$, which of the following represents the inverse function, $f^{-1}(x)$?

A $f^{-1}(x) = -\frac{1}{3}x - 5$

B $f^{-1}(x) = 3x - \frac{1}{5}$

C $f^{-1}(x) = 3x - 5$

D $f^{-1}(x) = 3x - 15$



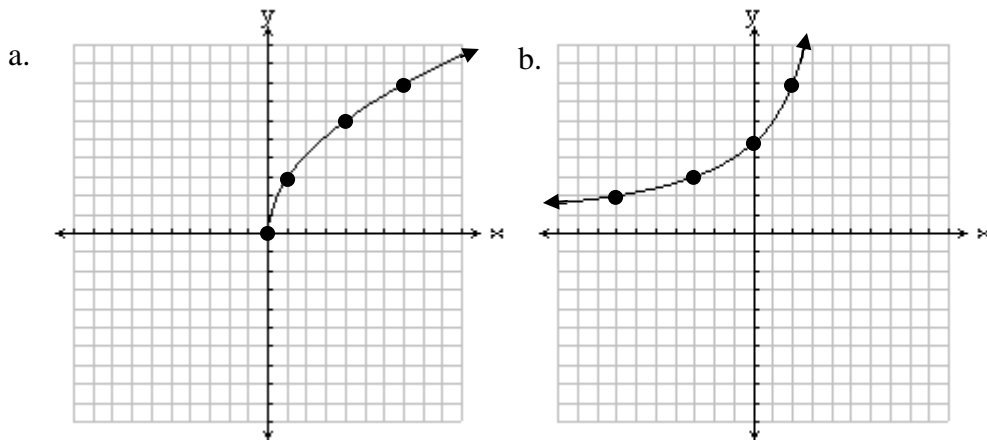
21. If $g(x) = 9x - 10$, determine the inverse function, $g^{-1}(x)$.



22. Let $f(x) = |x + 3| + 4$. What modification of the domain of $f(x)$ results in its inverse $f^{-1}(x)$, being a function?



23. For each function graphed below, sketch the inverse function.



For questions 24 through 29, use the following matrices.

$$A = \begin{bmatrix} 4 & 2 \\ 5 & -3 \end{bmatrix} \quad B = \begin{bmatrix} 7 & 1 & 9 \\ 8 & 5 & 3 \end{bmatrix} \quad C = \begin{bmatrix} 4 & x \\ 10 & 15 \end{bmatrix} \quad D = \begin{bmatrix} 1 & 5 & 6 & 3 & 1 \\ 9 & 7 & 3 & 4 & 0 \\ 4 & 2 & 3 & 1 & 8 \end{bmatrix}$$



24. What are the dimensions of the product matrix BD ?

A 2×5

B 5×2

C 5×3

D 3×5



25. Suppose there exists a matrix E such that the product matrix BE has 2 rows and 7 columns. What are the dimensions of matrix E ?



26. For what value of x is the determinant of matrix C equal to 15?



27. For what value of x will matrix C not have an inverse matrix?

A -6

B 0

C 6

D Matrix C will have an inverse matrix for every value of x .

28. If $AB = \begin{bmatrix} 44 & y & 42 \\ 11 & -10 & 36 \end{bmatrix}$, what is the value of y ?

29. Determine the value of x in matrix C such that $AC = \begin{bmatrix} 36 & 58 \\ -10 & -10 \end{bmatrix}$



30. If $f(x) = -x^2$, on what interval of x -values is $f(x)$ decreasing?



31. What are the right- and left-end behaviors of the function $f(x) = x^3 - 4x - 8$?

As $x \rightarrow \infty$, $f(x) \rightarrow$ _____

As $x \rightarrow -\infty$, $f(x) \rightarrow$ _____



32. What is the right- and left-end behavior of the function $f(x) = -x^4 - 4x^3 - 4$?

As $x \rightarrow \infty$, $f(x) \rightarrow$ _____

As $x \rightarrow -\infty$, $f(x) \rightarrow$ _____

33. Let $f(x) = x^5 - 3x^2 - 4$.



a. How many zeros does $f(x)$ have?

A 0

B 1

C 4

D 5

b. How many real number zeros does $f(x)$ have?

A 0

B 1

C 4

D 5

34. Let $f(x) = x^4 - x - 4$.



- a. How many zeros does $f(x)$ have?
- b. How many real number zeros does $f(x)$ have?

For questions 35 and 36;



- a. Determine the degree of the polynomial that models the data.
- b. Use the regression feature of your calculator to write a function that models the data.

35.

x	1	2	3	4	5
$f(x)$	5	14	37	80	149

36.

x	0	1	2	3	4
$f(x)$	3	6	11	18	27

For problems 37 and 38, solve for all values of x .



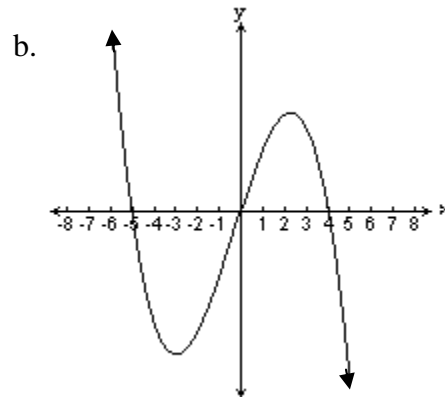
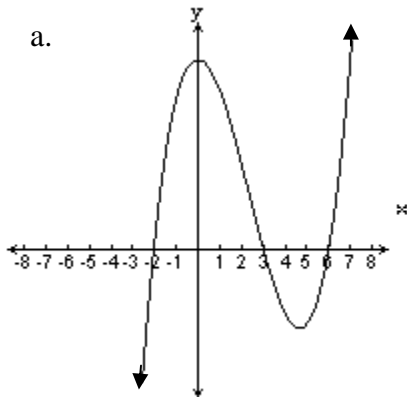
37. $x^2 - 3x + 11 = 0$



38. $3x^2 + x + 2 = 0$



39. Write an equation in factored form for the graphs shown below.



40. Given $f(x) = x^3 + 3x^2 - x - 3$
- Find the zeros of the function and sketch a graph.
 - Complete: As $x \rightarrow \infty$, $f(x) \rightarrow$ _____
 - Complete: As $x \rightarrow -\infty$, $f(x) \rightarrow$ _____



41. Let $f(x) = 4x^5 - 7x^3 + 5x^2 + 15$. Determine if each number below is a possible rational root (zero) according to the rational root theorem. Write yes or no for each number.

- a. 5 b. $-\frac{1}{4}$ c. $\frac{3}{2}$ d. 4 e. $\frac{1}{3}$



42. Using the rational root (zero) theorem, list the possible rational zeros of

$$f(x) = 5x^4 - 7x^2 + 4.$$



43. Determine if each expression below is a factor of $x^3 + 6x^2 - x - 30$. Write yes or no for each expression.

- a. $x - 2$ b. $x + 6$ c. $x - 5$
d. $x + 2$ e. $x + 3$ f. $x + 5$



44. Divide: $(2x^3 - 9x^2 - 8x + 15) \div (x - 5)$



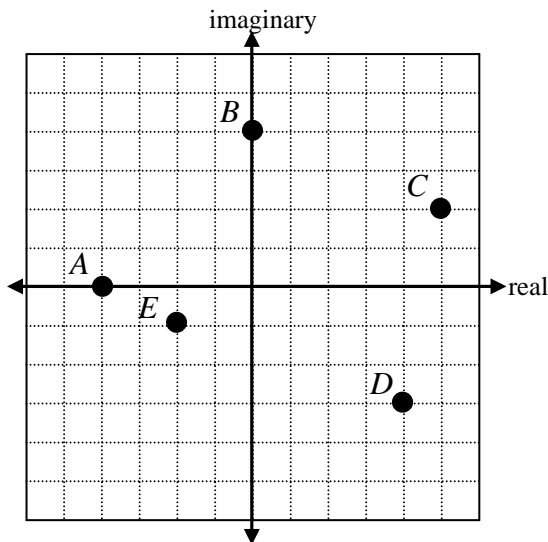
45. Fill in the blank with the number that completes the square.

a. $x^2 - 6x + \underline{\hspace{2cm}}$

b. $x^2 + 10x + \underline{\hspace{2cm}}$



46. Write the complex number represented by points A – E on the graph below.



47. Identify each of the following as real, pure imaginary, and/or complex.

a. $\sqrt{3}$

b. $\sqrt{-9}$

c. $5 + 2i$

For questions 48 through 55, perform the indicated operations.



48. $(3 + 2i) + (5 - 7i)$



49. $(5 - 6i)(1 - i)$



50. $(8 - 2i)(8 + 2i)$



51. $(2 - 7i)^2$



52. $\frac{7i}{2 - i}$



53. $\frac{2 + 7i}{1 + 6i}$



54. $|2 - 3i|$



55. $|5 + 12i|$

56. The solutions of $x^3 - x^2 - 50x - 48 = 0$ are $x = -6, -1,$ and 8 .a. Write the polynomial $x^3 - x^2 - 50x - 48$ in factored form.b. Solve the inequality $x^3 - x^2 - 50x - 48 \leq 0$ algebraically.57. The solutions of $x^3 - 6x^2 - 19x + 84 = 0$ are $x = -4, 3,$ and 7 .a. Write the polynomial $x^3 - 6x^2 - 19x + 84$ in factored form.b. Solve the inequality $x^3 - 6x^2 - 19x + 84 \geq 0$ algebraically.58. Write a polynomial function with real coefficients in factored form if two of its complex zeros are 3 and $9i$.59. Write a polynomial function with real coefficients in factored form if three of its complex zeros are $8, 7i,$ and $-5i$.

60. Barry's Burgers offers three different types of burgers at three different prices. The types are the Hamburger, the Cheeseburger, and the Barry Burger.

Jill and her friends visited Barry's Burgers three times.

One time, 3 Hamburgers, 5 Cheeseburgers, and 6 BarryBurgers cost \$25.24.
Another time, 2 Hamburgers, 7 Cheeseburgers and 5 BarryBurgers cost \$25.68.
The last time, 4 Hamburgers, 4 Cheeseburgers, and 7 BarryBurgers cost \$26.59.

- Write a system of equations that represents the situation. Be sure to define the variables.
- Represent the system as a matrix equation.
- Determine the cost of each type of burger.



61. Factor.

a. $x^3 - 125$

b. $x^3 + 64$

62. Find all zeroes of each function. Show how you determined the zeros.

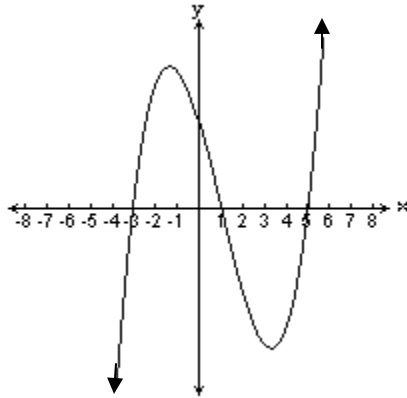
a. $f(x) = 125x^3 - 8$

b. $g(x) = 64x^3 + 27$

63. Solve the inequality $x^4 - 5x^3 - 25x^2 + 65x + 84 \geq 0$



64. Look at the graph of $f(x) = x^3 - 3x^2 - 13x + 15$ below.



Solve the inequality $x^3 - 3x^2 - 13x + 15 < 0$

For questions 65 and 66, Grid in and bubble your answers in the grids provided.

65. An arrow is shot from a height of 32 feet with an initial velocity of 56 ft/sec. The equation of the height $h(t)$ (in feet) of the arrow at time t (in seconds) is $h(t) = -16t^2 + 56t + 32$.

- a. After how many seconds will the arrow hit the ground?
- b. How many feet high will the arrow be at $t = 1.5$ seconds
- c. What is the maximum height, in feet, that the arrow will reach?

65a

	/	/	
	○	○	○
	0	0	0
①	①	①	①
②	②	②	②
③	③	③	③
④	④	④	④
⑤	⑤	⑤	⑤
⑥	⑥	⑥	⑥
⑦	⑦	⑦	⑦
⑧	⑧	⑧	⑧
⑨	⑨	⑨	⑨

65b

	/	/	
	○	○	○
	0	0	0
①	①	①	①
②	②	②	②
③	③	③	③
④	④	④	④
⑤	⑤	⑤	⑤
⑥	⑥	⑥	⑥
⑦	⑦	⑦	⑦
⑧	⑧	⑧	⑧
⑨	⑨	⑨	⑨

65c

	/	/	
	○	○	○
	0	0	0
①	①	①	①
②	②	②	②
③	③	③	③
④	④	④	④
⑤	⑤	⑤	⑤
⑥	⑥	⑥	⑥
⑦	⑦	⑦	⑦
⑧	⑧	⑧	⑧
⑨	⑨	⑨	⑨

66. The volume of a gift box is given by the function $V(h) = 4h^3 - 32h^2 + 60h$ where h represents the height of the box. The domain of the function is $0 < h \leq 3$.

What is the height (h) of the box with maximum volume?

66

	/	/	
	○	○	○
	0	0	0
①	①	①	①
②	②	②	②
③	③	③	③
④	④	④	④
⑤	⑤	⑤	⑤
⑥	⑥	⑥	⑥
⑦	⑦	⑦	⑦
⑧	⑧	⑧	⑧
⑨	⑨	⑨	⑨

67. Complete the chart

Function	Values of any local maximums	Values of any local minimums	Interval(s) where the function is increasing	Interval(s) where the function is decreasing
$f(x) = \frac{x^3}{3} + 2x^2 + x + 3$				
$g(x) = x^4 - 5x^2 + 4$				

68. Sam throws a ball up from the top of a building. The table below shows the height of the ball above the ground.

Time (sec)	Height (ft)
t	$f(t)$
0	400
1	434
2	436
3	406

- a. Write a polynomial function that bests models the data.
 - b. How high is the ball after 4 seconds?
 - c. When does the ball hit the ground?
69. Describe the relationship between the discriminant $b^2 - 4ac$ and the nature of the roots of the quadratic equation $ax^2 + bx + c = 0$.
70. A fourth degree polynomial equation with real coefficients could have how many imaginary roots?
71. Solve. $x(x - 6)(x + 2) > 0$