**SOL Review Topic 5: Graphs of Functions**

Logs, Exponentials, Absolute Value, Quadratics, Higher Order Polynomials, Cube, Cube Root, Square Roots, Rational Equations

*(Increasing, Decreasing, Domain, Range, Transformations, Asymptotes, Inequalities)*

Recognizing Graphs of Functions

What is the name of the function show in each graph below? What is the equation of the graph?

1) 2) 3)



4) 5) 6)



7)  8)

8) Which of the above graphs have a domain or all real numbers?

9) Which of the above functions have a range of all real numbers?

10) Which of the above functions have asymptotes? What are the equations of the asymptotes?

Transformation Equations

For each of the following, name the function and the vertex (or pivot point). Then give the equation of the function after it has been shifted right by three and down 2.

11)  12)  13) 

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_ Name: \_\_\_\_\_\_\_\_\_\_\_\_\_ Name: \_\_\_\_\_\_\_\_\_\_\_\_\_

Vertex: \_\_\_\_\_\_\_\_\_\_\_\_\_ Vertex: \_\_\_\_\_\_\_\_\_\_\_\_\_ Vertex: \_\_\_\_\_\_\_\_\_\_\_\_\_

Translated Equation: Translated Equation: Translated Equation:

  

14)  15)  16) 

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_ Name: \_\_\_\_\_\_\_\_\_\_\_\_\_ Name: \_\_\_\_\_\_\_\_\_\_\_\_\_

Vertex: \_\_\_\_\_\_\_\_\_\_\_\_\_ Vertex: \_\_\_\_\_\_\_\_\_\_\_\_\_ Vertex: \_\_\_\_\_\_\_\_\_\_\_\_\_

Translated Equation: Translated Equation: Translated Equation:

  

Domain, Range, Increasing Decreasing

For each of the following, determine the domain, range, intervals to which the function is increasing and decreasing, is sign of the leading coefficient and the end behavior.

17) 18)

Domain: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Domain: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Range: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Range: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Increasing: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Increasing: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Decreasing: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Decreasing: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Leading Coefficient: \_\_\_\_\_\_\_\_\_\_ Leading Coefficient: \_\_\_\_\_\_\_\_\_

Factors: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Possible Equation: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Asymptotes

Find all asymptotes of the following functions.

19)  20)  21) 

22)  23)  24) 



Inequalities

Graph the following inequality:

25) 

Zeros: Find  for the following functions. Name the # of real and imaginary solutions & degree.

Remember ’s = x-intercepts = zeros = solutions = roots.

26) 27)

= \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

# of Real Solutions = \_\_\_\_\_ # of Real Solutions = \_\_\_\_\_

# of Imaginary Solutions = \_\_\_\_\_ # of Imaginary Solutions = \_\_\_\_\_

Degree of Function: \_\_\_\_\_\_ Degree of Function: \_\_\_\_\_\_

EXTRA NOTES AND EXAMPLES:

**Functions**

Be able to recognize the graphs for the following functions: linear, quadratic, absolute value, polynomial (cube and cube root especially), exponential, and logarithm functions.

Equation examples: 🡪Linear (degree of 1), 🡪 Quadratic (degree of 2), 🡪Absolute Value,🡪Cube function, 🡪Cube Root, 🡪Exponential (a number raised to the *x* power), 🡪Logarithm

|  |  |
| --- | --- |
| Function | Equation etc |
| Linear | y = mx + b (SI)ax + by = c (SF) slopeb is (0,b) y-intercept point on the lineHorizontal line HOYy = #, zero slopeVertical lines are not functions (VUX) x = # undefined slope |
| Quadratic “U” Parabola Find Vertex by using “Calc” key maximum or minimum  |  y = a(x – h)2 + k Vertex (h,k) opposite samea>0 opens up, a< 0 opens down>1 stretch, <1 shrink  |
| Absolute Value “V” |  Vertex (h,k) opposite samea>0 opens up, a< 0 opens down>1 stretch, <1 shrink  |
| Square Root  |   opposite sameStarting point (h, k) a>0 opens up,a< 0 reflects down>1 stretch, <1 shrink  |
| Cube Root |  opposite same Turning Point (h,k)a>0 as graph on left , a< 0 reflects>1 stretch, <1 shrink  |
|  |  |
| Exponential Growth  | y = a(b)(x-h) + k b > 1y = k is the horizontal asymptote e  2.72 (natural log base e)  |
| Logarithmic |  (inverse of exponential). =  x = h is vertical asympt. Log is log base 10Ln is log base e |

EXTRA NOTES AND EXAMPLES:

**Polynomials:** To find the zeros of a polynomial equation, either:

1.) Graph the equation on your calculator and look at where the graph crosses/touches the x-axis

**Or** 2.) Solve the equation by factoring and setting each factor = 0 (may need to use the quadratic formula (given to you on the ‘formula’ screen.) You must do this when you cannot tell where the graph crosses or if it doesn’t cross the *x*-axis.)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Polynomials Example: Cubic Degree 3  | Zeros1. Real Zeros are the x values of the x intercepts. 2. Zeros are also called *roots,* or *solutions* 3. If the zero is *x* = h, then its factor is (x-h)  4. The number of zeros = the degree (this includes real, imaginary and double roots) | Types1. If there are no x ntercepts there are no real zeros, (all zeros will be imaginary) 2. A tangent implies a double root (repeated solution) 3. Irrational zeros come in pairs as do imaginary zeros  | Turns1. The maximum number of turns is equal to the degree – 1. | End Behavior1. If the leading coefficient (LC) is ‘+’ the right behavior rises, if the LC is ‘-‘ the right behavior falls 2. If the degree is *even*, right and left behavior will be the same, if the degree is *odd* right and left behavior is opposite. |

**Finding Domain/Range,**

A ‘Function’ means that *x*-values do not repeat---it must pass the vertical line test.

Domain – set of all *x*-values Range – set of all *y*-values

**Ex 1:** Find the Domain/Range of .

From the graph shown: (Note:  symbol means “all reals”)

Domain = All Real Numbers

Range = All Numbers Greater than -3

**Increasing/Decreasing Intervals**

As *x* increases from - infinity to + infinity (read from left 🡪right), do *y* values increase or decrease? The intervals will be the *x* values in these areas.

**Ex 3:** What are the decreasing intervals? The function decreases from (0, 2)

EXTRA NOTES AND EXAMPLES:

**Leading Coefficients**

If the function ends up, the leading coefficient is positive. If the function ends down, the leading coefficient is negative.



**Transformations**

What is the new equation shown in bold in the graph to the right?

The parent graph is the cube root function . The function is shifted down by 2 therefore the new equation is 

**Rational Functions:** See the chart for information on rational graphs:

|  |  |  |  |
| --- | --- | --- | --- |
| Rational Function | y =  where p(x) and q(x) are polynomial functionsq(x) 0 discontinuous  |  Domain all real numbers except the values that make q(x)= 0 Zeros of function set p(x)= 0 and solve | Vertical Asymptotes: Set q(x) = 0 and solve. Look at domain restrictions. Horizontal Asymptotes:1. Degree of p(x) < Degree of q(x) y = 0 2. Degree of p(x) > Degree of q(x) None 3. Degree of p(x) = Degree of q(x) y = LC of p(x)/LC of Q(x)   |

**Factors, Zeros and Equations**

What is the sign of leading coefficient of the graph to the right?

The leading coefficient is positive because the function ends up.

Determine the end behavior.

As  and As 

What are the factors?



What is a possible equation?



What are the zeros of the function? Remember - ’s = x-intercepts = zeros = solutions = roots.



PRACTICE J:





PRACTICE K:

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PRACTICE L:

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PRACTICE M:

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PRACTICE N:

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