

# Pre-Calculus Equations & Answers

### FUNCTIONS & THEIR GRAPHS

### Definitions

- A function is a relation in which each element of the domain is paired with only one element of the range.
- In most cases, x is the independent variable and y or f(x) is the dependent variable.

- Linear Functions A function whose graph is a non-vertical line or part of a non-vertical line. There
- are 3 forms of linear equations: slope-intercept, point-slope, and standard form. Slope-intercept forms: y = mx + h, where m is the slope and h is the y-intercept of Oher Birme.
- EX; If a line has a slope of 3 and y-intercept of 3, the equation is y = 3x + 3.
- Point-slope forms y − y<sub>1</sub> = m(x − x, ), where = is the slope and (x<sub>1</sub>, y<sub>2</sub>) is a point on the line.
- EX: If a line has a slope of -2 and contains the point (%, -4), the equation is
- y = (-4) = -2(x 6) or y + 4 = -2(x 6). Standard form: Ax + By = C, where A, B, and C are integers and A is positive. The slope is  $-\frac{a}{2}$  and the y-intercept is  $\frac{a}{2}$ . This form of a line is most often used to find intercepts by plugging 0 in for x and y separately and solving.
- EX: Given the line 3x + 2y = 4, the slope is  $-\frac{1}{2}$  and the y-intercept is 2. The intercepts can also be found by substitution:
- x-innercept (plug in 0 for y): 3x + 2y = 4 3x + 200y = 4 3x = 4 x = 8p-intercept (plug in 0 for x):
- No: 2y 4 3(0) 2y 4 2y 4 y 2

### **Polynomial Functions**

- A function is a polynomial function if it can be written in the form  $f(x) = ax^{n} + bx^{n-1} + cx^{n-1} + ax + e$
- The greatest power of a polynomial with one variable is called its degree.
  - · When the degree of the function is odd, there is at least one real zero; when the degree is even, there may be no real zeros.
  - Both types can have imaginary roots of the form a + hr.
- $EX_1(x) = 2x^2 + 3x^2 x + 4$  has a degree of 3, one real zero at x = -2.1601, and two non-real resets.

### Quadratic Functions

- Written in the form  $f(x) = ax^2 + bx + c$ , where  $a \neq 0$
- The axis of symmetry is the vertical line with equation x = <sup>12</sup>
- The y-intercept is c.
- Quadratic functions can be written in vertex form. f(x) = a(x h)<sup>x</sup> + k, where (A. It) is the vertex of a parabola that opens up when a > 0 and opens down sufficiency of 45 Oc.
- Quadratic functions can have mone, one, or two real-member solutions.
- The graph is a porabola if the parabola opens left or right—it is not a function. · The vertex is the critical point where the graph changes from increasing to decreasing or decreasing to increasing.

### Markade for Challes Cont.

Equation	Method	Justification	Sobution
-9-0	Separat Resets	There is no x-toms.	x <sup>2</sup> - 9 - 0 x <sup>2</sup> - 9 x - 3 or -3
vi + 2x - 8 - 0	Factoring	8 has only a few factors to check.	$x^{2} + 2x - 8 = 0$ 4x + 40(x - 2) = 0 x = -4  or  2
2e* + 5e - 9 = 0	Quadratic Formula  -0.1 √0′ - 4m  2e	The equation cannot be factored.	$x = \frac{-5 \pm \sqrt{(-5)^2 - 4(2)(-6)}}{2(2)}$ $x = \frac{-5 \pm \sqrt{67}}{4}$
n² - 8n +3 - 0	Completing the Square or Quadratic Formula	The coefficient of the x*-term is 1 but the equation cannot be factored.	$x^{0} - 8x + 3 = 0$ $x^{0} - 8x + -3 = -3$ $x^{0} - 8x + 16 = -3 = 16$ $x^{0} - 8x + 16 = 13$ 4x - 4y = 13 $x - 6 = 3x^{0}/3$

The discriminant is the expression under the radical in the Quadratic Formula and can be used to determine the number of real solutions.

- · A function can be identified using the vertical line text. If a vertical line passes through the graph of the function in more than one point, the graph is not a fu-
- · A function can be represented by an equation in terms of a and y or with function notation: y = Tx - 11 or f(x) = Tx - 11.

### Discriminant: N - Aut > 0

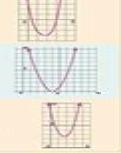
- March Street ... The said the state of
- The discriminant is  $(-7)^2 4(2)(3) 25$ , which is positive.
- There are two real number solutions.



- $EX_{2} x^{2} 8x + 16 = 0$
- The discriminant is (-80' 4019/165 = 0)
- There is one real number solution.



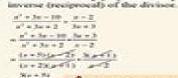
- $EX_{i}: 2x^{i} 2x = 8 = 0$
- The discriminant is (-7y' 4(2)(3) = -15, which is negative.
- There are no real number solutions.



### **Potional Functions**

A rational function is an equation of the form  $f(x) = \frac{\rho(x)}{q(x)}$ , where  $\rho(x)$  and q(x) are polynomial functions and  $q(x) \neq 0$ .

- · Rational functions may have breaks in continuity that appear in the graph as vertical
- asymptotes or point discontinuities that appear as holes. Vertical asymptotes occur where a rational function is undefined.
- Point discontinuities occur where there is a common factor in the numerator and denominator. To multiply: First multiply the numerators. To divide: Multiply by the multiplicative



A Contact is important for division. ds = 20To add and subtract: There must be a common denominator. To find it for rational expressions with polynomials in the denominator, factor first to determine common factors.

The common denominator is the LCM

femal common multiplet of the denominators.

### s'-s-20 2s-10 . Adding: $me = mme - S_0 - 2(n - S)$

Using one of each factor, the LCM is 20x = 40cx - 5).

- Multiply each fraction's numerator and denominator by the factors missing from the LCM.
- 5 2 7 (x+4) (x + 4)(x - 5) 2 2(x - 5) (x + 4) 340 20 - 28 20x+40x-20 20x-50x+40 2 to 4 300 20x - 500x + 41



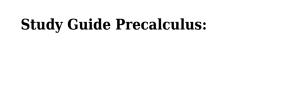
Using one of each factor, the LCM is 6h - 236h + 596h - 41.Multiply each fraction's numerator and denominator by the factors missing from the LCM.





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