Modeling with Algebra

**Formula Sheet**

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| **Name** | **Definition** | **Formula** |
| Linear Function | A linear function shows a constant rate of change between two variables. Its graph is a straight line. | $$f\left(x\right)=mx+b $$* *m* = slope (rate of change)
* *b* = *y*-intercept (starting value)
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| Slope Formula | Slope tells you how steep a line is. It shows how much y changes for every change in x. | $$m=\frac{y\_{2}−y\_{1}}{x\_{2}−x\_{1}}$$* $$\left(x\_{1}, y\_{1}\right)$$and $$\left(x\_{2}, y\_{2}\right)$$ are two points on the line
* *m* = slope
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| Arithmetic Sequence Formulas | An arithmetic sequence is a list of numbers where you add the same value each time. | * Explicit Formula: $$A\_{n}=a\_{1}+\left(n−1\right)d$$
* Recursive Formula: $$A\_{1}=first term$$, $$A\_{n}=a\_{n−1}+d$$

\*Written as a function: $$f\left(n\right)=a\_{1}+\left(n−1\right)d$$ |
| Geometric Sequence Formulas | A geometric sequence is a list of numbers where you multiply by the same value each time. | * Explicit Formula: $$A\_{n}=a\_{1}⋅r^{\left(n−1\right)}$$
* Recursive Formula: $$A\_{1}=first term$$, $$A\_{n}=r⋅a\_{n−1}$$

\*Written as a function: $$f\left(n\right)=a\_{1}⋅r^{\left(n−1\right)}$$ |
| Quadratic Function` | A quadratic function models a curved pattern (called a parabola). It has one squared variable and changes direction once. | Standard Form: $$f\left(x\right)=ax^{2}+bx+c$$* *a* = controls the direction and width of the parabola
* *b* = affects the position of the vertex
* *c* = y-intercept (starting value when x=0)

Vertex Form: $$f\left(x\right)=a\left(x−h\right)^{2}+k$$* *(h,k)* = vertex of the parabola
* *a* = controls the opening direction and stretch
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| Exponential Function | An exponential function grows or decays quickly. The variable is in the exponent, not the base. | $$f\left(x\right)=a⋅b^{x}$$* *a* = starting value
* *b* = growth (if *b>1*) or decay (if *0<b<1*) factor
* *x* = number of time periods or steps
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| Scatterplot | A scatterplot is a graph that shows points based on two variables. It helps you see patterns, trends, or relationships between the variables. |  |