



1 Variables


1.1 Variables and functions

- What's the difference between a variable and a constant?  
- How variables are named and their units specified?
- What we mean by function or dependence?
- How to distinguish the dependent from the independent variable?
- What's the (realistic) domain for a function?
- How to describe a range of values using an inequality?
- What notations are used for equal values and for and approximate values?
- How to calculate a percent increase?


1.2 Tables and graphs

- Where the independent and dependent variables appear in a table and in a graph?
- How to guess values from a table or from a graph?
- How to make a graph from a table?
- Why we start each axis at 0?
- What we mean by scaling an axis evenly?
- How to make a table and then a graph from a story?
- Why we draw in a smooth line or curve connecting the points?

1.3 Rate of change (and interpolation)

- How to calculate rate of change between two points?
- What the rate of change means in the story? 
- How we can use the rate of change to estimate values?
- When a function is increasing or decreasing, and the connection to the rate of change?
- Why the rate of change is zero at the maximum (or minimum) value of a function?
- What the connection is between rate of change and the steepness of the graph?
- How to sketch or read trends from a qualitative graph?

1.4 Units

- How to convert from one unit of measurement to another?
- What a unit conversion fraction is?
- Why multiplying by a unit conversion fraction doesn't change the amount, just the units?
- How to connect repeated conversions into one calculation?
- Which should be the larger number — the amount measured in a small unit, or the amount measured in a large unit? 
- How many seconds in a minute, minutes in an hour, hours in a day, days in a year, inches in a foot, feet in a mile, and other common conversions? *Ask your instructor which conversions you need to remember, and whether any conversion formulas will be provided during the exam.*

1.5 Metric system and scientific notation*

- Why scientific notation is used?
- What the standard format is for scientific notation?
- How to convert between expanded decimal notation and scientific notation?
- How your calculator reports numbers in scientific notation, and what (might be) different when you're reporting that number?
- How to enter numbers written in scientific notation into your calculator?
- What the terminology is for standard powers of 10, such as million and billion?
- Why metric prefixes are used?
- What common metric prefixes mean, such as kilo, mega, giga, tera, centi, milli, micro, nano, pico? *Ask your instructor which prefixes you need to remember, and whether any prefixes will be provided during the exam.*
- How to convert between English and metric measurements? *Again, ask your instructor which conversions you need to remember, and whether any conversion formulas will be provided during the exam.*

2 Equations

2.1 A first look at linear equations


- How to generalize an example to find the equation of a function?
- Where the dependent variable is in the standard form of an equation?
- What the slope of a linear function means in the story and what it tells us about the graph?
- What the intercept of a linear function means in the story and what it tells us about the graph?
- What the template is for a linear equation? *Ask your instructor if you need to remember the template or if it will be provided during the exam.*
- Where the slope and intercept appear in the template for a linear equation?
- What makes a function linear?
- How to plot negative numbers on a graph?
- What the graph of a linear function looks like?

2.2 A first look at exponential equations

- What percent means and how to convert between percents and decimal?
- How to find the growth factor if you know the percent increase?
- How to calculate percent increase in one step?
- What makes a function exponential?
- What the template is for an exponential equation? *Ask your instructor if you need to remember the template or if it will be provided during the exam.*
- Where the starting value and growth factor appear in the template for an exponential equation?
- What the graph of an exponential function looks like?



2.3 Using equations

- Where equations come from? 
- Where the dependent and independent variable (usually) are in an equation?
- What it means to evaluate?
- How to evaluate an function when the independent variable occurs more than once?
- How to generate a table or graph from an equation?
- What graphs of different types of functions look like?

2.4 Approximating solutions of equations

- What a solution to an equation is?
- When you solve an equation (as opposed to just evaluating)?
- How to use successive approximation, including organizing your work in a table?
- How to get a reasonable first guess from a graph?
- What to do if you do not have a reasonable first guess?
- What precision your answer should be?
- How to find numbers between given numbers, for example between .3 and .4?

2.5 Finance formulas*


- How to determine which formula to use? *Ask your instructor if you will be told which formula to use during the exam.*
- What the quantities a , p , y , and r mean in the story?
- How to evaluate the formulas on your calculator? *Ask your instructor which formulas you need to remember, and whether any formulas will be provided during the exam.*
- Why parentheses are needed around the exponent, numerator, and denominator in most of the formulas?
- What APR means, and why it is different from the (nominal) interest rate?

3 Solving equations

3.1 Solving linear equations

- When you solve an equation (as opposed to just evaluating)?
- Why we “do the same thing to both sides” of an equation when solving?
- How to solve a linear equation?
- What are some advantages and disadvantages of solving versus successive approximation?
- How to check that a solution is correct using the equation?

3.2 Solving linear inequalities

- What some common phrases are that indicate an inequality?
- How to represent the idea of “between” using a double-sided inequality?
- Why we “do the same thing to both sides” of an inequality when solving?
- How to solve a linear inequality?
- Why the inequality sign is reversed if we switch sides of the equation?
- When to evaluate versus solve an equation versus solve an inequality? 




3.3 Solving power equations (and roots)

- What we mean by square root, cube root, and n th root?
- How to calculate square roots, cube roots, and n th roots on your calculator?
- What a “power” equation is?
- When you solve an equation (as opposed to just evaluating)?
- How to solve a power equation?
- What are some advantages and disadvantages of solving versus successive approximation?
- How to check that a solution is correct using the equation?
- What the graph of a power function looks like?

3.4 Solving exponential equations (and logs)

- What “log” means?
- What the connection is between logs and scientific notation?
- How to evaluate logs on your calculator?
- How to evaluate the LOG DIVIDES FORMULA using your calculator?
- When to use the LOG DIVIDES FORMULA? *Ask your instructor if you need to remember the LOG DIVIDES FORMULA or if it will be provided during the exam.*
- When you solve an equation (as opposed to just evaluating)?
- How to solve an exponential equation?
- What are some advantages and disadvantages of solving versus successive approximation?
- How to check that a solution is correct using the equation?
- What the graph of an exponential function looks like?

3.5 Solving quadratic equations*

- What is a quadratic function? A polynomial? 
- When you solve an equation (as opposed to just evaluating)?
- How to solve a quadratic equation?
- What are some advantages and disadvantages of solving versus successive approximation?
- When do we use the QUADRATIC FORMULA?
- How to solve a quadratic equation when the function is not set equal to zero?
- How to find the values of a, b, c in the formula? 
- How to evaluate the formula (using your calculator)? *Ask your instructor if you need to remember the QUADRATIC FORMULA or if it will be provided during the exam.*
- Why there are (usually) two solutions to a quadratic equation?
- How to decide which solution(s) from the QUADRATIC FORMULA are correct?
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- What the graph of a quadratic function looks like?
- What value do we use for the independent variable to find the highest (or lowest) value of a quadratic function?

4 A closer look at linear equations

4.1 Modeling with linear equations

- What makes a function linear?
- What the slope of a linear function means in the story and what it tells us about the graph?
- What the intercept of a linear function means in the story and what it tells us about the graph?
- What the template is for a linear equation? *Ask your instructor if you need to remember the template or if it will be provided during the exam.*
- How to write a linear equation given the starting amount (intercept) and the rate of change (slope)?
- Where the slope and intercept appear in the template of a linear equation?
- What the graph of a linear function looks like?
- How to solve a linear equation?
- Why the rate of change of a linear function is constant?

4.2 Systems of linear equations

- How to compare two linear functions using a table?
- How to graph two linear functions on the same axes?
- What the solution of a linear system means in terms of the story?
- Where to look on a graph to see the solution of a linear system?
- How to successively approximate the solution of a linear system?
- How to solve a linear system?
- When to use inequality instead of an equation for a linear system?

4.3 Intercepts (and direct proportionality)

- What the intercept of a linear function means in the story and what it tells us about the graph?
- Where the intercept appears in the template of a linear equation?
- How to calculate the intercept given the slope and an example (another point on the graph)?
- Why an intercept might not make sense, for example if it's outside the domain of the function?
- When a linear function is a direct proportion?
- Why you cannot reason proportionally if the linear function is not a direct proportion?
- What the graph of a direct proportion looks like?

4.4 Slopes

- Which types of situations are linear?
- What the slope of a linear function means in the story and what it tells us about the graph?
- Where the slope appears in the template of a linear equation?
- How to calculate the slope between two points?
- What it means if the slope is negative?
- How to find the equation of a line through two points?
- How to find a linear function given two examples in a story?
- If both the slope and intercept are unknown, which is easier to calculate first?

4.5 Fitting lines to data*

- What a scatter plot is?
- Why we would approximate data with a linear function?
- When it is acceptable for a line to not go through all of the data points?
- How to decide visually whether a line is a reasonable approximation of the data?
- What we call a point that falls very far away from an approximating line?
- How to calculate the residuals, and what they tell us?
- What the correlation coefficient tells us?
- What a secant line of a curve is?
- When linear interpolation is an overestimate vs. an underestimate, and what that has to do with the shape of the graph?
- What the “best-fitting” (or least squares) line is?

5 A closer look at exponential equations

5.1 Modeling with exponential equations

- What makes a function exponential?
- What the template is for an exponential equation? *Ask your instructor if you need to remember the template or if it will be provided during the exam.*
- How to write an exponential equation given the starting amount and percent increase?
- Where the growth factor and starting amount appear in the template of an exponential equation?
- What “doubling time” means?
- What the graph of an exponential function looks like?
- When to use the LOG DIVIDES FORMULA? *Ask your instructor if you need to remember the LOG DIVIDES FORMULA or if it will be provided during the exam.*
- How to solve an exponential equation using the LOG DIVIDES FORMULA?
- How to calculate the rate of change of an exponential function?
- Why the rate of change of an exponential function is not constant?

5.2 Exponential growth and decay

- How to write an exponential equation given the starting amount and growth (or decay) factor?
- How to write an exponential equation given the starting amount and percent decrease?
- How to read the starting amount and percent decrease from the equation?
- What “half-life” means?
- What the graph of exponential growth and exponential decay look like?
- Why the rate of change for exponential decay is negative?

5.3 Growth factors

- Which types of situations are exponential?
- How to evaluate the PERCENT CHANGE FORMULA using your calculator? *Ask your instructor if you need to remember the PERCENT CHANGE FORMULA or if it will be provided during the exam.*
- When to use the PERCENT CHANGE FORMULA?
- How to evaluate roots on your calculator?
- How to evaluate the GROWTH FACTOR FORMULA using your calculator? *Ask your instructor if you need to remember the GROWTH FACTOR FORMULA or if it will be provided during the exam.*

- When to use the GROWTH FACTOR FORMULA?
- How to find the growth factor given the starting amount and another point of information?
- How to find the growth factor given the doubling time or half-life?

5.4 Linear vs exponential models


- What the template is for a linear equation?
- How to find the linear equation between two points (a start and end value)?
- When we might think a model might be linear?
- What the template is for an exponential equation?
- How to find the exponential equation between two points (a start and end value)?
- When we might think a model might be exponential?
- Why we compare linear and exponential models?
- How to look at a scatter plot and decide if the data looks linear versus exponential?

5.5 Logistic growth (and other models using the constant e)*

- What is the approximate value of the constant e ?
- How do you evaluate a power of e on your calculator?
- When we might think a model might be logistic function?
- What the graph of a logistic function looks like?
- What the limiting value of a logistic function means in the story and what it tells us about the graph?
- How to estimate the limiting value of a logistic function by successive approximation?
- Where the limiting value appears in the template of a logistic equation?
- How to evaluate, make a table, and draw a graph of functions involving the constant e ?
- How to use the graph to approximate the solution of an equation involving the constant e , and how to refine that estimate using successive approximation?

Appendix More about

A.1 Approximation, decimal numbers, and rounding

- What the symbol for “approximately equal to” is?
- Why an approximate answer is often as good as we can get?
- What the term “precisely” refers to?
- What the saying “I’d rather be approximately right than precisely wrong” means?
- What the difference is between rounding off, rounding up, and rounding down?
- When to round your answer, and when to round your answer up or down (instead of off)?
- How to round a decimal to the nearest whole number?
- How precisely to round an answer? 
- How to compare sizes of decimal numbers?
- What the symbol for “greater than” is?

A.2 Arithmetic operations

- When to add, subtract, multiply, or divide numbers?
- What is the difference between subtraction and negation?
- How to add, subtract, negate, multiply, and divide on a calculator?
- How multiplication is related to addition?
- How fractions are related to division?
- What the term “per” indicates?

A.3 Percentages

- How to convert between decimal and percent?
- How to calculate percentage of a number?
- How to calculate percent increase or percent decrease?

A.4 Powers, roots, and logarithms

- How powers are related to multiplication?
- What a root means?
- What a logarithm means?
- When to raise a number to a power, take a root, or take a logarithm?
- How to raise to a power, take roots, and take logarithms on a calculator?

A.5 Order of operations

- What the order of operations is?
- Where roots and logs appear in the order of operations?
- Why do you need to know what the order of operations is?
- When to override the order of operations?
- How to override the order of operations using parentheses?



A.5 Algebraic notation

- Where multiplication can be hidden in algebraic notation?
- How powers are written in algebraic notation?
- What operation a fraction corresponds to?
- How to evaluate an algebraic expression on your calculator?
- What the conventional standards are for algebraic notation, including the ordering of numbers and letters?
- How to evaluate formulas using your calculator?