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 nth root?

- How to calculate square roots, cube roots, and nth 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 calcuator?

- 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?

- 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 is 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 calcuator? *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 calcuator? *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?

  To one decimal place?

  To two decimal places?

- 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.6 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?