

**Problem 1 [20]**

An ant can build a pile of sand by adding 3 grains of sand per trip. Suppose an ant starts working on an unfinished pile that has already had 150 grains of sand added.

- (a) Is the number of grains of sand in the pile growing at a linear or exponential rate in relation to the number of trips?
- (b) Write down a model that approximates how much sand will be in the pile after  $x$  trips.
- (c) Graph your model
- (d) How much sand is in the pile after 1000 trips?

**Problem 2 [20]**

At a second pile of sand a group of ants can reduce the size of the pile by  $1/5$  every trip. Suppose a pile starts with 250000 pieces of sand.

- (a) Is the rate of decrease of the size of the pile linear or exponential?
- (b) Write down a model that approximates how much sand will be in the pile after  $x$  trips.
- (c) Graph your model.
- (d) How many trips will it take to have less than 10 grains of sand left in the pile?

**Problem 3 [20]**

John really likes stamps. He starts a campaign on the internet where people send him stamps. John has 156 stamps in his collection to start with. After 1 day of the campaign, John has 176.28 stamps. After day 2, John has 199.1964 stamps.

- (a) Find a model that approximates John's collection after  $x$  days and graph it.
- (b) How many stamps does John have after 38 days?
- (c) Between the 27th and 28th days, what is the average number of stamps John is receiving per hour?

**Problem 4 [20]**

Alice invests \$2000 in a savings account that pays 6.1% APR.

- (a) Write down the formula for the amount in Alice's account after  $t$  years for a simple interest model and a compound interest model. (You should write down 2 formulas total).
- (b) Which model is linear?
- (c) How much will interest does each model provide Alice with after 23 years?

**Problem 5 [20]**

Bob wants to compare an account that pays 7.1% APR compounded once every 2 months and an account that pays 7.5% APR compounded once every 4 months.

- (a) Write down formulas for the amount in each account after 1 year and compare them. Which is higher?
- (b) Find the annual yield,  $Y$ , of each account and compare them. Which is higher?
- (c) Do your answers for the first two parts match? Why or why not?