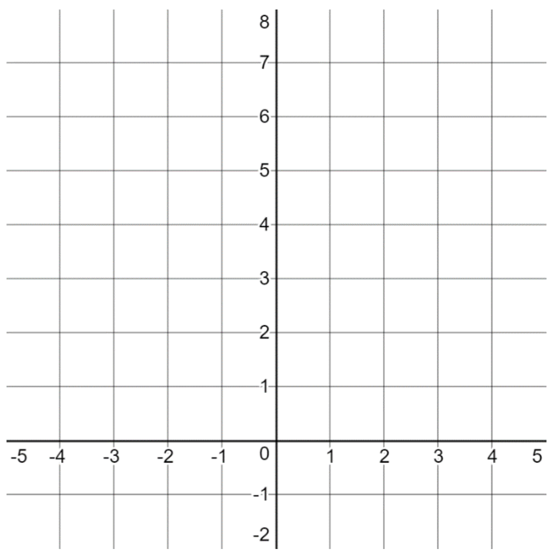
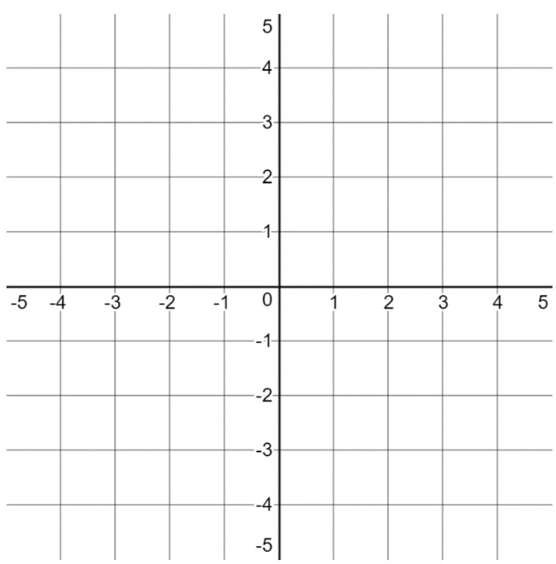
Exponential Functions

Goal:
• Can graph exponential functions of the form $f(x) = base^{x/T}$ • Understands that $base$ is the rate of growth/decay and T is the length of one growth/decay period • Can transform the exponential function in the form $f(x) = a(base)^{b(x-c)} + d$ to fit the need of the problem • Can sketch e^x
Terminology: • Exponential growth/decay • Euler's number

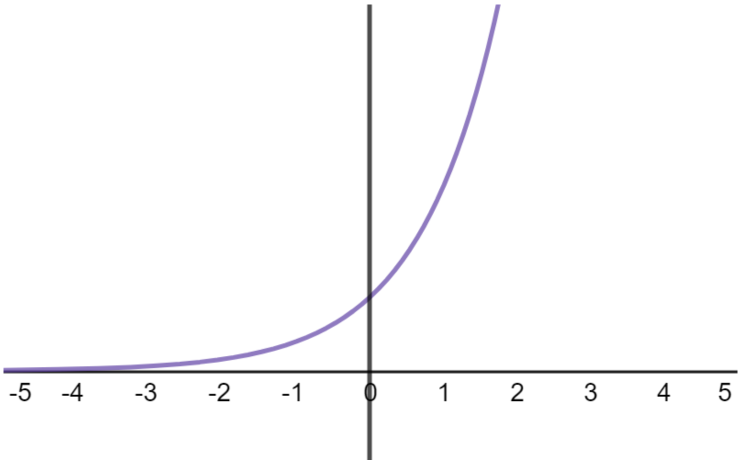
Consider the equation $f(x) = 2^x$. Graph it using a table of values and describe the characteristics.



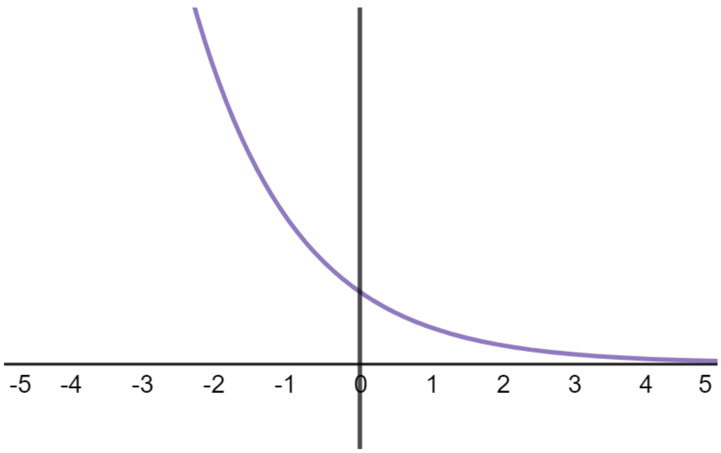
Do the same for the functions $g(x) = 1^x$; $h(x) = \left(\frac{1}{2}\right)^x$; and $k(x) = (-2)^x$ and graph it on the same graph below.



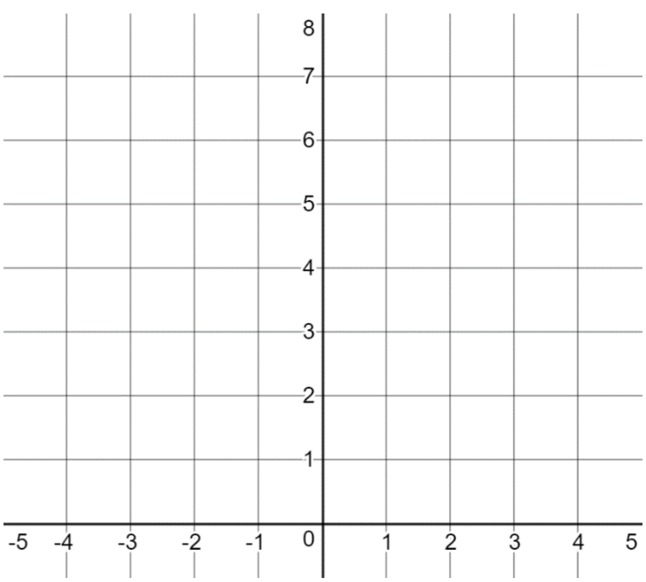
The general graph form $y = b^x$ for $b > 1$

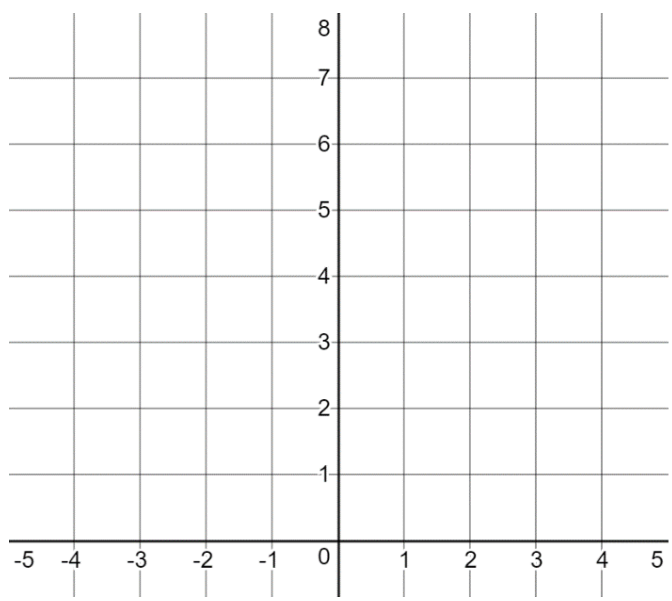


If $b \in (0,1)$, then



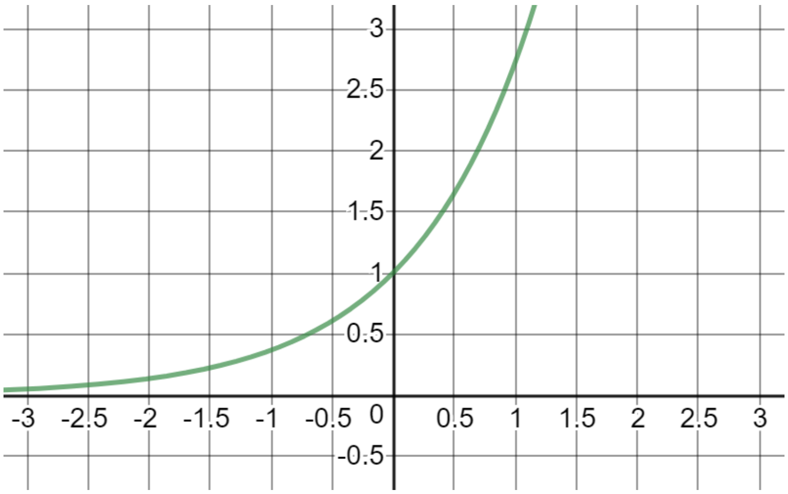
Practice: Graph the functions $f(x) = 5^x$; $g(x) = \left(\frac{1}{4}\right)^x$; $h(x) = 3^x$; $k(x) = \left(\frac{2}{3}\right)^x$





Arguably the most important exponential function is

$$f(x) = (2.71828\ldots)^x = e^x$$



The beauty is that we can change from one base to another.

$$f(x) = 2^x = (e^{0.7})^x = e^{0.7x}$$

We'll talk more about this Monday on finding that power for e, but right now just be comfortable that we can do this at least through guess and check and when you start doing calculus you will only want to work with e.

The application of exponential functions is when we have populations of something that grow proportionally to the current size of the population (ie, bacteria growth, radioactive decay, information spreading)

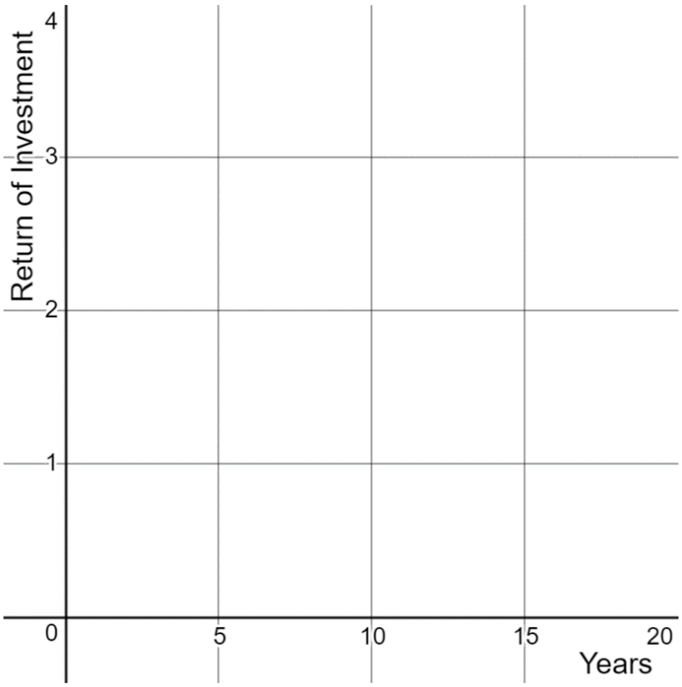
Consider the specific case where a population doubles every year.

Population	1						
Time	0						

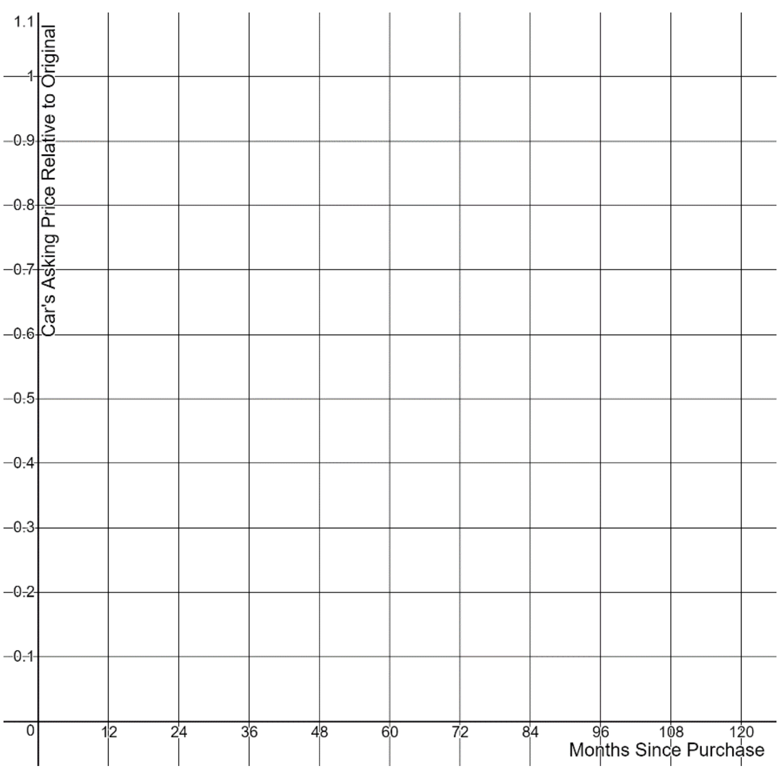
And then the general case where a population grows at a rate r and it takes T years to grow that much or that little.

Population	1						
Time	0						

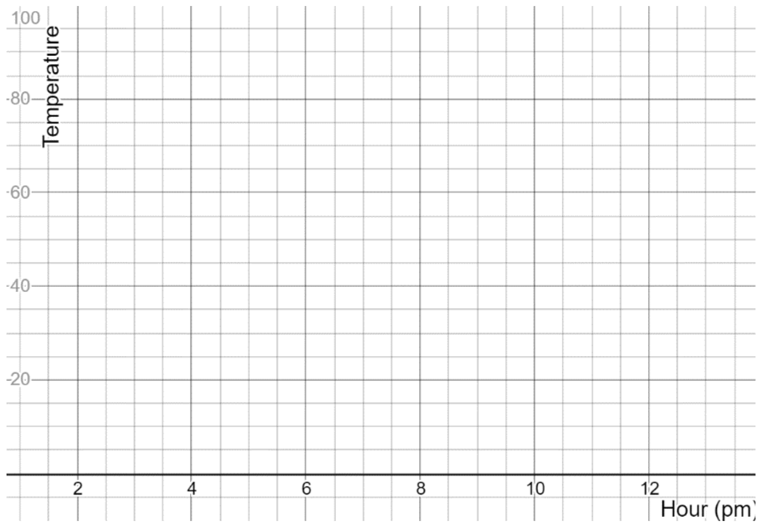
Example: A given investment is expected to return 7% annually (every year). Determine an equation for the amount the investment grows after t years. Graph the equation for the given domain.



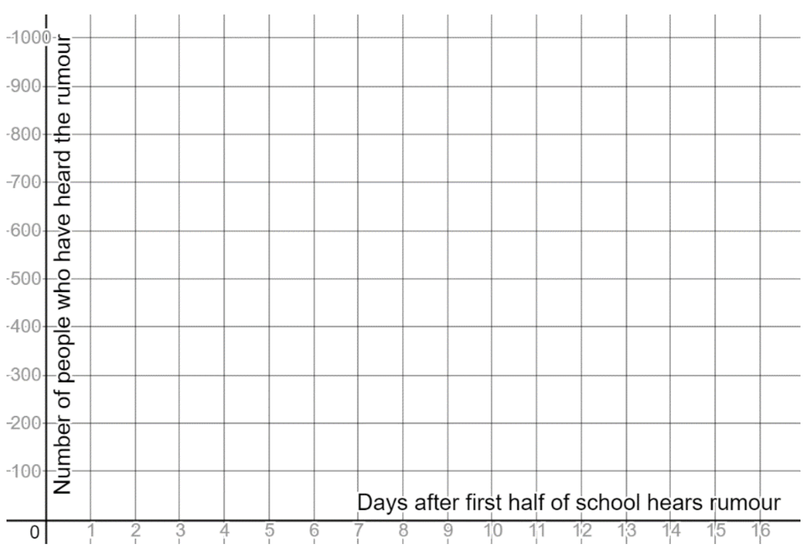
Practice: The price of a car decreases in price by about 15% every 12 months. Determine an equation for the car's value compared to the buying price after m months. Graph the equation for the given domain



Example: A baked pie comes out of the oven and is $80°C$ at 4pm, it is left to cool until dinner at 7pm when the temperature is $24°C$. If the temperature of the room is $20°C$ then make an equation for the temperature of the pie at time t (pm)



Practice: After a rumour has initially spread, the number of new people who hear the rumour decreases exponentially. Prince of Wales has about 1000 students and after 500 people have heard the rumour it takes 3 days for another 200 to hear it. Determine an equation that describes the number of people who have heard the rumour at time t after the first 500 people hear it.



Suggested Practice Problems: 7.1 page 342-345 # 4-10, 14 7.2 page 354-357 # 3, 7-12	
Textbook Reading: 7.1 and 7.2 page 334-342 and 346-354 Key Ideas on page 342 and 354	
Next Class: Log function	