Math Final practice test: Applications

Geometric:

Equations of a curve: Find the equation of a curve that satisfies the statements given.

1) The subnormal at any point (x,y) and the line joining the origin to that point form a scalene triangle having the x-axis as a base. Erik Fallon

2) Find all curves with equal subtangents and subnormals. Erik Fallon

3) Find all curves so that the subtangent is equal to the square root of the abscissa. Erik Fallon

4) The length of the perpendicular from the origin to a normal line of the curve is equal to twice the abscissa of the point of contact (x,y). Erik Fallon

5) The length of the subnormal is proportional to the square of the coordinate. Kristen Schandall

Compute the tangent, and normal lines to the graph. y=4x^2-8x+2 Kristen Schandall

Find the intersection of the tangent line with the y-axis of y=2x Kristen Schandall

Find the intersection of the normal line with the x-axis of y=2x Kristen Schandall

Orthogonal trajectories: FInd the curves that intersect the given curves at 90 degree angles.

1) $y=2x-5+ke^{3x}$ Erik Fallon

2) $3/2y=2x^2/(k-x)^2$ Erik Fallon

3) $y=2k/(3x^n)$ $(n>0)$ Erik Fallon

4) $y^3=2x^4(3-2kx)$ Erik Fallon

5) $8x+4y=k$ Kristen Schandall

6) 1/2y=6kx^n (n>0) Kristen Schandall

Populations:

A certain city had a population of 20,000 in 1940 and a population of 35,000 in 1980. Assume that its population will continue to grow exponentially at a constant rate. What population can its city planners expect in the year 2010? Austin Scampini

For a logistic population P(t) of fish in a lake, suppose K = 1 & M = 4, measured in hundreds, after (t) years. Suppose that we allow harvesting in the pond at a rate of 300 fish per year. Study the model. (H = 3) Austin Scampini

Suppose that the population P(t) of a country satisfies the differential equation dP/dt =kP(300- P) with k constant. Its population in 1950 was 200 million and was then growing at the rate of 2 million per year. Predict this country's population for the year 2010.
Austin Scampini

As the salt KNO3 dissolves in methanol, the number x.t/ of grams of the salt in a solution after t seconds satisfies the differential equation $dx/dt = 0.4x - 0.002x^2$. Austin Scampini

A population P(t) of small rodents has birth rate B = (.001)P (births per month per rodent) and constant death rate delta. If P(0) = 100 and P(0) = 8, how long (in months) will it take this population to double to 200 rodents? (Suggestion: First find the value of delta.) Austin Scampini

Springs:

(free damped) A 10 kg object is stretched by spring 4m. Assume a damped force of 20 N, determine the equation of motion initially released from 2 m with a velocity of 5 m/s. Frank Mitchell

(free damped) A 1 kg object is attached to a 20 N/m spring with 9 N of friction. Find x(t) if the object is initially at rest and has a velocity of 2 m/s. Express it in phase/angle notation and graph it. Frank Mitchell

(free undamped) A spring with a spring constant 15 N/m is attached to a 3 kg mass with negligible friction. Find the frequency, period, phase angle and lag of the system. Frank Mitchell

(free undamped) A 4 lb object is supported by a 100 lb/ft spring. Determine the frequency, period, and amplitude of this system. Frank Mitchell

(forced) A spring with a spring constant of 8 N/m is attached to a 1 kg mass with 6 N of friction is under a constant force of 4 cos(t) N.

a) Find x(t) and express it in phase/angle notation
b) Find the particular solution that satisfies x(0) = 1 and x'(0) = 3

Frank Mitchell

(forced) A 2 kg object is attached to a spring with a spring constant 18 N//m with 12 N of friction and a constant force of 3 cos(t) N.

a) Find x(t) when the object is initially at rest then moves with a velocity of 1 m/s
b) Graph the function and label amplitude, frequency, period, and lag.

Frank Mitchell

Torricelli:

A tank of fuel has a hole 25 m below the surface. The hole has a diameter .4 m. If the coefficient of discharge is .98 when the hole is opened. What is the flow rate of the fuel.

Frank Mitchell

A tank of water has a hole 9 m below the surface with a diameter of 2 m. How long does it take the tank to become empty.

Frank Mitchell

A full hemispherical water tank has a radius of 4m has its flat side as its bottom. It has a bottom hole of radius 2cm. If the bottom hole is opened at 2pm when will the tank be empty?

Kristen Schandall

A water tank has the shape of obtained by y=x^2 around the y axis. The water depth is 4ft at 1pm. When the circular plug on the bottom of the tank is removed. At 2 pm the depth of the water is 1 ft.

a) What time will the tank be empty?
b) If the top surface of the water has a radius of of 2ft, what is the radius of the circular hole on the bottom ?

Kristen Schandall