GAMES Course 1 Final Exam

Multiple-Choice

1. How many trees can be planted in a tract of land 10m wide and 15m long if the trees have to be spaced 1m apart?

   (a) 10 X 16

   (b) 11 X 16

   (c) 12 X 16

   (d) 10 X 16

2. Which of the following is an example of a geometric sequence?

   (a) $1, 10, 20, 30, 40, \ldots\ldots$

   (b) $1, 10, 100, 1000, 10000, \ldots\ldots$

   (c) $1, 4, 9, 16, 25, \ldots\ldots\ldots$

   (d) $1, 10, 50, 100, 150, \ldots\ldots\ldots$

3. If you wish to add up only numbers which satisfy a certain criteria, which in-built function in Excel would you use?

   (a) SUMIF

   (b) MAXIF

   (c) MINIF

   (d) AVERAGEIF

4. In order to make $f(x)$ close to L, what are we requiring x to get close to $f(x) = \lim_{x \to a} = L$?

   (a) L

   (b) $f(x)$

   (c) a

   (d) $f(a)$

5. For the power rule to apply, what has to be true about the power?

   (a) Nothing, it can be any number

   (b) It can be a positive or negative integer

   (c) It has to be a real number

   (d) It has to be a positive integer

6. What is the limit as $x \to \infty$ of 2?

   (a) 0

(b) 2

(c) $-\infty$

(d) ∞

7. $(p(a+h)-p(a))/h$ is the slope of the

   (a) tangent line at $t=a$

   (b) tangent line at $t=a+h$

   (c) secant line through $(a,p(a))and(a+h,p(a+h))$

   (d) secant line through $(p(a),a)and(p(a+h),a+h)$

8. The first step to using implicit differentiation is to

   (a) calculate the value of y using x.

   (b) calculate the value of x using y.

   (c) recognize that y is an implicit function of x.

   (d) * re-arrange so x is isolated on one side of the expression.

9. $f = x^2 v(x)$ where v is a function, then

   (a) * $\frac{df}{dx} = 2xv(x) + x^2 v'(x)$

   (b) $\frac{df}{dx} = 2xv'(x)$

   (c) $\frac{df}{dx} = x^2 v'(x)$

   (d) $\frac{df}{dx} = xv(x) + x^2 v'(x)$

10. If $a \in X$ is a global maximum on f, then

   (a) $f(a) > f(x)$ for some x.

   (b) $f(x) > f(a)$ for all a.

   (c) $f(x) < f(a)$ for some a.

   (d) $f(a) > f(x)$ for all x.

Short Answer Questions

1. A firm XYZ Inc. uses three inputs X, Y and Z to produce an output I according to the formula: $I = 2\sqrt{X} + 4\sqrt{Y} + \sqrt{Z}$. This is an example of a production function, a concept that is commonly used in economics and business.

   (a) If it uses 4 units of X, 16 units of Y and 9 units of Z, how much I will it produce?

   (b) Suppose it doubles its inputs to 8 units of X, 32 units of Y and 18 units of Z, how much I will it produce?

   (c) If it already has 8 units of X and 32 units of Y, how many units of Z will it need to produce 50 units of I?

2. Consider a model of infection spread. Suppose each person interacts with N people each day. If a person is infected, the chance of him/her spreading it to a person that he/she meets is p. Thus on average, an infected person will spread the infection to pN persons.

   Assume for simplicity that an infected person is contagious for only 1 day i.e. stops spreading it after 1 day.

   (a) If 1 infected person enters a population today without any previous infection, how many people are likely to be infected in 1 day, and in t days?

   (b) If 10 infected persons entered the population today which didn't have any previous infections, how many people are likely to be infected in 1 day, and in t days?

   (c) Starting from 10 infections, compute how many infections there are likely to be in 5 days if $p = 0.1$ and $N = 20$.

3. Find the following sums.

   (a) $1 + 2 + 3 + 4 + ... + 80$

   (b) $1 + \frac{1}{2} + (\frac{1}{2})^2 + (\frac{1}{2})^3 + (\frac{1}{2})^4$

4. Kim goes to a physiotherapist, who asks him to increase his weight-training regimen gradually over time to rebuild his strength. He asks Kim to start with 2 lbs on day 1, and then increase it by 20% every day.

   (a) If Kim were to follow this regimen, how much weight would he be lifting on day 5 and on day t?

   (b) How much total weight would he have lifted over 10 days? Write this as a sum of 10 terms and also using the summation notation.

   (c) Evaluate the total weight Kim would have lifted over 10 days.

5. Find linear approximations of y about $x = 0$ for the following.

   (a) $y = (1 - x)^{1/6}$

   (b) $y = (5x + 3)^{-2}$

6. Supply-Demand Model with a Tax – Consider a linear supply and demand model where consumers pay a tax of τ per unit.

$$D = a - 500\,(P + \tau) \qquad\qquad S = \alpha + 100P$$

   a and α are positive constants. The equilibrium price is found when supply equals demand:

$$a - 500\,(P + \tau) = \alpha + 100P$$

   (a) Solve the above for Price, P.

   (b) When the tax rate increases, does the price, P, increase or decrease? Use implicit differentiation to find $\dfrac{\mathrm{d}P}{\mathrm{d}\tau}$ and interpret your results.

7.

$$f\,(x) = \frac{32x}{2x^2 + 1}$$

   (a) Find all critical points. Assume the domain includes $-\infty \leq x \leq \infty$.

(b) Use the first derivative test and a sign diagram to evaluate all critical points.

(c) Use the second derivative test to verify your result in part 7b.

8. Dosage for drugs, D, is measured in miligrams (mg) and depends on a patient's weight, W in kilograms (kg). The function of this relationship is: $D = f(W)$

   (a) Express the relationship $f(60) = 40$ in a sentence with units.

   (b) Express the relationship $f'(60) = 6$ in a sentence with units.

   (c) Estimate the dosage for a 65 kg person.