BARUCH COLLEGE - DEPARTMENT OF MATHEMATICS
MTH 2205 - APPLIED CALCULUS

Textbook: Gordon, Wang and Materowski, *Applied Calculus for Business, Economics and Finance*, Second Edition, Pearson, 2015. http://www.mypearsonstore.com/stores/AppliedCalc Username: pearson Password: welcome
If you purchased your course materials last semester for MTH 2003, you can use your same MyMathLab and e-Text for MTH 2205. Simply click on the MyMathLab link and you should be taken into your course without needing to purchase access.
Graphing calculator required: Texas Instruments TI-89 or TI-92 Plus
Tutoring is available at SACC, Room 2-116, Vertical Campus, (646) 312-4830

- Videos and Final Exam Review available at the Blackboard MTH 2205 Master ALL Blackboard Site.
- Calculator Exercises are posted on the Master Blackboard ALL site in the Course Document tab.
- Answers to the textbook exercises may be found at www.baruch.cuny.edu/math/Applied_Calculus/
- Supplementary Exercises are given below and are to be worked out as indicated in Sections 3.6, 5.7 and 5.8.

Sect	Topic	MML Assignment	Calculator Exercises	Text	Practice Final Exam
	Review of Differentiation from MTH 2003	Review of Differentiation		*P. 198: 30, 37* *P. 205: 4, 13, 27, 31* *P. 219: 17, 24* *P. 248: 5, 8* *P. 258: 9, 10, 21, 28* *P. 279: 14, 18*	
3.1	Extrema of a Function of a Single Variable	3.1	8, 9, 31, 70	1, 3, 5, 6, 7, 11, 24, 15, 17, 18, 20, 21, 22, 25, 30, 32, 33, 34, 35, 36, 39, 40	A1, A19, B1, B19, B25, C1, C18, D1, D12, D19, D25, E1, E12, E13, A26, B26, C26, D34, E26
3.2	First Derivative Test	3.2	10, 11, 44	3, 5, 7, 8, 10, 11, 12, 13, 14, 18, 19, 20, 23, 25, 26, 27, 29, 32, 35, 38, 39, 40, 42, 43, 45	A2, B2, C2, D2, E2
3.3	Concavity and the Second Derivative Test	3.3	4, 13, 41, 43, 61	1, 2, 3, 4, 11, 13, 14, 15, 16, 17, 18, 19, 25, 27, 31, 33, 37, 38, 41, 44, 49, 51, 67, 68, 69,71, 76	A3, A6, A20, B3, B20, C3, C19, D3, D13, D20, E3, E4, E20, E23, A27, A34, B27, C27, D26, E34
3.4	Applications I - Geometric Optimization	3.4	20, 40, 72	1, 2, 3, 5, 7, 8, 9, 13, 14, 17, 19, 20, 21, 23,26, 30	A4, B4, C4, C20, D4, E19
3.5	Applications II - Business and Economic Optimization	3.5	18, 71	1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 12, 13, 14, 16, 18	A5, A21, B5, B21, C7, C21, D5, D14, D21, E5, E14, E21, E24, B28

Sect	Topic	MML Assignment	Calculator Exercises	Text	Practice Final Exam
3.6	Linearization and Differentials	3.6 S1, S2, S3, S4, S5, S6	19, 37	1, 2, 3, 4, 5, 6, 7, 8, 13, 14, 15, 19, 20, 21, 23, 24,28, 29	A22, B6, B22, C6, C22, D6, D15, D22, E6, E15, A28, B29, C28, D27, D28, E35
4.1	Inverse Functions	3.7 S16, S17, S18, S19, S20	9	1, 5, 7, 9, 11, 15, 17, 19, 21, 24, 25, 29, 31, 35, 39, 42,43, 46, 48, 49, 51, 54, 56, 59, 61, 63, 64, 66 67, 68, 69, 71, 72	A7, B7, C5
4.2	Exponential Functions	4.2	49	1, 2, 4, 5, 7, 10, 11, 13, 17, 18, 23, 25, 26, 27, 36, 37, 41, 43, 44, 45, 49, 51, 53, 55, 58, 59, 61, 63, 67, 68	A8, B8, C8
4.3	*e*	4.3		1, 2, 3, 7, 8, 10, 11, 12, 13, 15, 17, 24, 25, 26, 27, 28, 29, 30, 31. 32, 33	A9, B9, C9, A29, C29, D33, E27
4.4	Derivative of Exponential Functions	4.4	15, 22, 24, 25, 26, 29, 33, 34, 35, 36, 42	1, 3, 4, 5, 8, 9, 11, 12, 14, 15, 17, 18, 19, 21, 23, 24, 25, 26, 27, 28, 30, 31, 33	A10, A23, B10, B23, C10, C23, D7, D16, E7, A30, A33, B35, C30, D29, E28, E29
4.5	Logarithmic Functions	4.5	38, 52, 53, 55, 62, 63	1, 3, 4, 6, 7, 9, 10, 13, 15, 16, 17, 19, 21, 23, 25, 27, 29, 32, 34, 37, 39, 45, 47, 49, 53, 54, 55, 59, 61, 64, 65	A11, B11, C11, E8, E16, D30, E30
4.6	Properties of Logarithmic Functions	4.6	3, 17, 32, 73, 75	1, 5, 7, 11, 15, 17, 19, 21, 23, 25, 29, 31, 35, 37, 39, 41, 45, 53, 57, 61, 65, 67, 68, 69, 73, 77, 79, 81, 82, 87, 89, 92, 96, 97.99, 101, 102, 104, 105	A12, A24, B12, B24, C12, C24, D8, D17, D23, E9, E17, E22, E25 A31, B30, B34, C31, D31, D32, E31
4.7	Applications	4.7	27, 47, 48, 50, 54	1, 2, 3, 4, 5, 6, 7, 8, 17, 18, 21, 37, 39	B31, B33, C33, D35, E32
5.1	Antiderivatives	5.1		1, 3, 4, 5, 7, 8, 11, 12, 14, 17, 19, 22, 25, 26, 29, 31, 32, 33, 35	See next assignment
5.2	Applications of Antiderivatives	5.2		1, 3, 5, 6, 8, 11, 15, 16, 18, 21, 23, 25, 27, 28, 29, 30, 31, 33, 34, 35	A13, B13, C13, D9, E10

Sect	Topic	MML Assignment	Calculator Exercises	Text	Practice Final Exam
5.3	Substitution*	5.3		1, 3, 4, 7, 8, 9, 11, 12, 14, 15, 17, 19, 21, 25, 27, 29, 33, 35, 37, 38	A14, B14
5.4	Approximation of Areas	5.4	2, 5, 12, 74	1, 3, 5, 6, 9, 10, 13, 16, 18, 20, 23, 27, 28, 30, 32	A15, A31, C32, E33
5.5	Sigma Notation and Area	5.5		1, 3, 9, 11, 12, 15, 17, 18, 19, 20, 21, 23, 26, 27, 28, 29, 31, 35, 36, 40, 41, 42, 43	B15, C14, A35. B32, C34
5.6	Definite Integral	5.6	1, 7, 46	1, 5, 7, 9, 11, 15, 19, 21, 23, 24, 25, 27, 31, 39, 41, 42, 45, 47, 51, 57, 61, 62, 63	A16, B16, C15, D10
5.7	Substitution*	5.7 S13, S14, S15	6, 23, 56, 58, 59	3, 7, 8, 9, 11, 15, 18, 20, 21, 23, 26, 28, 31, 33, 34, 36, 38, 39	A17, A25, B17, C16, C25, D11, D18, E11, E18
5.8	Applications	5.8 S8, S9, S10, S11, S12	14,16, 21, 28, 30, 45, 51, 57, 60, 64, 65, 66, 67, 68, 69	1, 2, 4, 5, 7, 8, 15, 16, 17, 18, 19, 21, 23, 37, 39, 40, 41	A18, B18, C17, A32, C35

*In sections 5.3 and 5.7, students are expected to do basic substitutions both with and without the calculator.

The following supplemental exercises should be assigned as indicated in the syllabus:

S1. Let *f* be the function defined by $f(x)=\frac{1}{x+1}$. Write the equation of the tangent line to *f* at $x=0$ and from that line estimate $f(0.1)$.

a) 0.9 b) 0.909 c) 0.826 d) 0.476 e) -0.227

S2. Write the equation of the line tangent to $f(x)=\sqrt{x}$ at $x=4$ and from that line approximate $\sqrt{3.98}$.

a) 1.9949 b) 1.995 c) 1.98 d) 1.9975 e) 1.997

S3. Consider the curve defined by $-8x^2+5xy+y^3=-149$. Write an equation of the line tangent to the curve at the point $(4,-1)$ and from that line estimate *y* when $x=4.2$.

a) -0.373 b) 0.373 c) 0.4 d) -0.398 e) -0.4

S4. Given a differentiable function with the following properties: $f(2)=5,\ f'(2)=-3\ \ and\ \ f''(2)=-4$. From the line approximate $f(1.98)$ and determine if the approximation is too large or too small.

a) 5.092 Too small b) 5.0592 Too large c) 5.06 Too small d) 5.06 Too large
e) 4.94 Too large

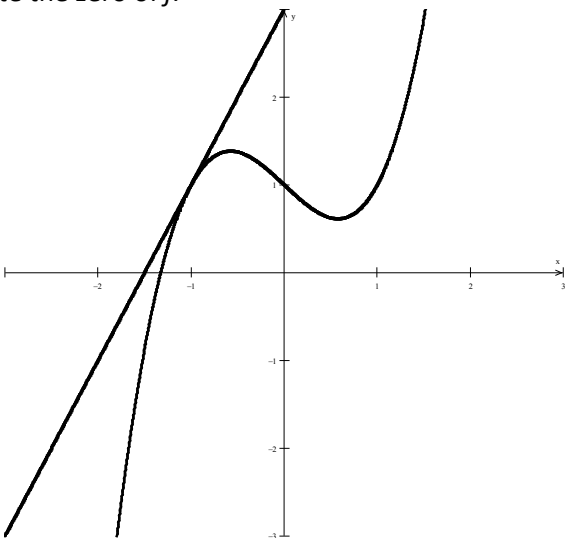
S5. Write an equation of the line tangent to $f(x)=3x^4+x^3-21x^2$ at the point $(2,-28)$ and from this line approximate $f(2.01)$.

a) -27.76 b) -27.9 c) -28.02 d) -28.03 e) -28.05

S6. For the function *f*, $f'(x) = 2x+1$ and $f(1) = 4$. What is the approximation for $f(1.2)$ found by using the line tangent to the graph of *f* at $x = 1$?

a) 0.6 b) 3.4 c) 4.2 d) 4.6 e) 4.64

S7. Below is the graph of the function *f* defined by the equation $f(x) = x^3 - x + 1$. A tangent is drawn to *f* at $x = -1$. Using the equation of the tangent line, estimate the zero of *f.*



a) -1.5 b)-1.45 c) -1.55 d) -1.48 e) -1.53

S8. A particle moves along the *x*-axis. The velocity of the particle at time *t* is given by $v(t)$ and the acceleration of the particle is given by $a(t)$. Which of the following gives the average velocity of the particle from time $t = 0$ to $t = 8$?

a) $\dfrac{a(8)-a(0)}{8}$ b) $\dfrac{1}{8}\displaystyle\int_0^8 v(t)\,dt$ c) $\dfrac{v(8)-v(0)}{8}$ d) $\dfrac{1}{2}\displaystyle\int_0^8 v(t)\,dt$

e) $\dfrac{v(0)+v(8)}{2}$

S9. (Calculator) Water is being pumped into a tank at the rate of $r(t) = 30\left(1-e^{-0.16t}\right)$ gallons per minute, where *t* is the number of minutes since the pump was turned on. How much water was pumped in during the first 20 minutes?

a) 380 gallons b) 420 gallons c) 829 gallons d) 1220 gallons
e) 1376 gallons

S10. (Calculator) If the rate of growth of the population of deer in a forest is modeled by $R(t) = 2000e^{0.23t}$ deer per year, where *t* is the number of years from today, by how many deer has the population grown in 3 years?

a) 3,987 b) 5,487 c) 8,641 d) 10,141 e) 12,628

S11. (Calculator) A pizza is taken out of an oven. The temperature of the pizza is changing at the rate of $-110e^{-0.4t}$ degrees Fahrenheit per minute. By how many degrees Fahrenheit has the pizza cooled in the first 5 minutes?

a) 112°F b) 119°F c) 147°F d) 238°F e) 335°F

S12. (Calculator) The rate at which people enter an amusement park on a given day is modeled by the function *E* defined by

$$E(t) = \frac{15600}{t^2 - 24t + 160}$$

where $E(t)$ is measured in people per hour and the time t is measured in hours after midnight. The function is valid for $9 \le t \le 23$. How many people have entered the park by 5 PM ($t = 17$)?

a) 2,361 b) 8,365 c) 6,004 d) 7,275 e) 9,637

S13. A population of rabbits is given by the formula

$$P(t) = \frac{1000}{1 + e^{4.8 - 0.7t}}$$

where *t* is the number of months after a few rabbits are released. After how many months is the population of rabbits growing most rapidly?

a) After about 3.5 months b) After about 5 months c) After about 6.9 months
d) There is no maximum growth rate e) After about 1,000 months (about 83 years)

S14. The number of students infected by the measles in a certain school is given by the formula

$$P(t) = \frac{200}{1 + e^{5.3 - t}}$$

where *t* is the number of days after students are first exposed to an infected student. How many students have been infected by the measles when the disease is growing most rapidly?

a) 5 students b) 75 students c) 90 students d) 100 students
e) 200 students

S15. When an infected person is introduced into a closed and otherwise healthy community, the rate of growth of the number of people, *P,* who become infected with the disease can be modeled by the differential equation below

$$\frac{dP}{dt} = kP\left(1 - \frac{P}{A}\right)$$

where *k* is a positive infection rate and *A* is the number of people in the community. For what value of *P* is the disease growing most rapidly?

a) The disease is growing most rapidly when 25% of the population is infected.
b) The disease is growing most rapidly when 35% of the population is infected.
c) The disease is growing most rapidly when 50% of the population is infected.
d) The disease is growing most rapidly when 65% of the population is infected.
e) The disease is growing most rapidly when 75% of the population is infected.

x	$f(x)$	$f'(x)$
0	49	0
1	2	-8
2	-1	-80

S16. The table above gives selected values for a differentiable and decreasing function *f* and its derivative. If f^{-1} is the inverse function of *f* what is the value of $\left(f^{-1}\right)'(2)$?

a) -80 b) $-\frac{1}{8}$ c) $-\frac{1}{80}$ d) $\frac{1}{80}$ e) $\frac{1}{8}$

S17. Let *f* be a function defined by $f(x)=3x^3+2x+1$. If $g(x)=f^{-1}(x)$ for all *x* and the point $(0,1)$ is on the graph of *f*, what is the value of $g'(1)$?

a) $\frac{1}{11}$ b) $\frac{1}{2}$ c) 1 d) 2 e) 11

S18. Let *f* be the function defined by $f(x)=2x^3+x$. If $g(x)=f^{-1}(x)$ and $g(3)=1$, what is the value of $g'(3)$?

a) $\frac{1}{55}$ b) $\frac{1}{3}$ c) $\frac{1}{7}$ d) 7 e) 55

S19. Let *f* be the function defined by $f(x)=x^3+3x-5$. Let $f^{-1}(x)$ be the inverse function of *f*. Find $\left(f^{-1}(9)\right)'$ the derivative of $f^{-1}(x)$ at $x=9$.

a) $\frac{1}{15}$ b) 15 c) 246 d) $\frac{1}{246}$ e) $\frac{1}{9}$

S20. Let *f* be the function defined by $f(x)=4x^5+3x^3+2$. Let $f^{-1}(x)$ be the inverse function of *f*. Find $\left(f^{-1}(9)\right)'$ the derivative of $f^{-1}(x)$ at $x=9$.

a) $\frac{1}{f'(9)}$ b) $f'(9)$ c) 29 d) $\frac{1}{29}$ e) 9

Problem	*Answer*
S1.	a
S2.	b
S3.	e
S4.	d
S5.	a
S6.	d
S7.	a
S8.	b
S9.	b
S10.	c
S11.	d
S12.	c
S13.	c
S14.	d
S15.	c
S16.	b
S17.	b
S18.	c
S19.	a
S20.	d

LEARNING GOALS OF COURSE:

Upon completion of this course students will

- Use the derivative to determine the extrema of a function
- Utilize the calculus to study the behavior of functions
- Utilize the calculus to maximize revenue and minimize cost of typical functions arising in Economics and Finance
- Apply the skills learned in precalculus to exponential and logarithmic functions
- Use antiderivatives to determine the area of planar regions and apply these skills to determine consumer and producer surplus.