

Purdue University

Study Guide for MA 223

for students who plan to obtain credit in MA 223 by examination.

Textbook: Applied Calculus For Business, Economics, and the Social and Life Sciences,
Expanded ninth edition.

Author: L. D. Hoffman and G. L. Bradley

Publisher: McGraw Hill, 2007

When you are ready for the examination, obtain the proper form from your academic advisor. Follow the instructions on the form.

To prepare for the exam, you should obtain from the MA 223 course web page, or from the Undergraduate Services Office (MATH 242):

1. the assignment sheet
2. the final exam practice problems

The url for the course web page is:

<http://www.math.purdue.edu/courses/ma223>

The assignment sheet lists the sections of the text that are covered in the course. (A copy of the text is on reserve in the Hicks Undergraduate Library.) The homework problems from the assignment sheet, along with the final exam practice problems, provide good preparation for the exam.

A calculator with logarithmic and exponential functions will be needed for the exam. **Any brand of one-line calculator may be used. However, no multi-line calculators are allowed.** Cell phones and PDA's may not be used as a calculator.

Text: Applied Calculus by S.T. Tan, Sixth Edition, Brooks/Cole, 2005.

A calculator with logarithm and exponential functions is required. Calculators may be used when appropriate on the assignments below. **Graphing calculators or programmable calculators may not be used on quizzes or exams.** Calculators which are capable of numerical or symbolic differentiation or integration are considered programmable and are not allowed on exams.

<u>Lessons</u>	<u>Sections</u>	<u>Assignments</u>
1	1.2, 1.4	<i>p</i> 23 : 26, 27, 28, 29, 47, 48, 49, 69, 70; <i>p</i> 41 : 1 – 6
2	1.4	<i>p</i> 43 : 11, 14, 19, 22, 29, 30, 32, 33, 41, 44, 45, 46
3	2.1	<i>p</i> 58 : 3, 7, 12, 23, 24, 27, 29, 34, 37, 42, 45, 70, 75
4	2.2	<i>p</i> 76 : 26, 28, 29, 31, 34, 35, 37, 39, 44, 47, 51
5	2.3	<i>p</i> 87 : 15, 16, 17, 18, 20, 24, 28, 31, 33, 60, 63, 65
6	2.4	<i>p</i> 111 : 4, 6, 8, 9, 14, 33, 51, 56, 57, 60, 62
7	2.4, 2.5	<i>p</i> 113 : 64, 66, 67, 68, 73, 76, 77, 78; <i>p</i> 127 : 1, 4, 6, 40, 41, 42
8	2.5, 2.6	<i>p</i> 129 : 55, 58, 60, 61, 63, 64, 70; <i>p</i> 150 : 12, 15
9	2.6	<i>p</i> 150 : 16, 19, 22, 23, 26, 29, 32, 34
10	3.1	<i>p</i> 168 : 2, 5, 10, 13, 14, 20, 21, 23, 26, 30, 33, 34, 35, 36
11	3.1	<i>p</i> 169 : 42, 44, 46, 47, 51, 54, 55, 56, 59
12	3.2	<i>p</i> 182 : 1, 5, 6, 8, 16, 17, 20, 21, 25, 26
13	3.2	<i>p</i> 183 : 10, 29, 31, 32, 33, 39, 44, 46, 47, 50, 56, 57
14	3.3	<i>p</i> 195 : 2, 3, 5, 9, 11, 13, 16, 18, 21, 31, 32
15	3.3	<i>p</i> 195 : 34, 39, 42, 49, 52, 55, 56, 57, 78, 80
16	3.4	<i>p</i> 212 : 4, 5, 6 <i>ab</i> , 10, 12, 13 <i>abc</i> , 15 <i>ab</i> , 16
17	3.5	<i>p</i> 219 : 5, 7, 10, 14, 15, 18, 19, 29, 34
18	3.6	<i>p</i> 231 : 2, 4, 9, 12, 13, 14, 16, 18, 20, 22
19	3.6	<i>p</i> 232 : 31, 33, 34, 35, 36, 39, 40, 41
20	3.6	<i>p</i> 232 : 42, 48, 49, 50, 52, 54, 56, 60
21	3.7	<i>p</i> 244 : 15, 16, 17, 18, 20, 21, 23, 24, 30, 32, 35, 38
22	4.1	<i>p</i> 263 : 13, 19, 21, 22, 24, 26, 30, 33, 34
23	4.1	<i>p</i> 264 : 53, 55, 60, 61, 64, 66, 73, 74, 79, 87
24	4.2	<i>p</i> 283 : 22, 26, 35, 40, 44, 45, 54, 56, 59, 61, 68
25	4.2	<i>p</i> 281 : 9, 10, 11, 12, 69, 70, 71, 75, 83, 85
26	4.3	<i>p</i> 297 : 12, 19, 20, 33, 34, 35, 44, 52, 54, 56
27	4.4	<i>p</i> 312 : 16, 18, 20, 23, 25, 31, 35, 45, 51 <i>ab</i> , 56
28	4.5	<i>p</i> 325 : 1 – 8
29	4.5	<i>p</i> 326 : 9, 10, 15, 16, 21, 23, 28
30	5.1	<i>p</i> 337 : 19, 22, 23, 24, 25, 26, 28, 29, 32
31	5.2	<i>p</i> 347 : 18, 19, 22, 23, 25, 27, 31, 32, 34, 36, 40, 41, 42
32	5.3	<i>p</i> 359 : 2, 3, 7, 9, 10, 12, 18, 21, 22, 25, 28, 34, 37
33	5.4	<i>p</i> 368 : 2, 4, 7, 9, 13, 20, 22, 23, 27, 34, 36, 37, 39
34	5.4, 5.5	<i>p</i> 368 : 47, 48, 54; <i>p</i> 379 : 4, 6, 10, 14, 15, 21, 27
35	5.5	<i>p</i> 379 : 48, 50, 51, 54, 56, 63, 64
36	5.6	<i>p</i> 388 : 3, 6, 7, 8, 9, 15, 23

Formulas which are provided on the final exam are at the end of this practice final.

- Find the slope of the line containing the points $(-2, 4)$ and $(6, -3)$.
A. 4 B. $-\frac{7}{8}$ C. $\frac{1}{4}$ D. $-\frac{8}{7}$ E. $-\frac{1}{2}$
- Suppose 280 tons of corn were harvested in 5 days and 940 tons in 20 days. If the relationship between tons T and days d is linear, express T as a function of d .
A. $T(d) = 5d + 280$ B. $T(d) = -44d + 500$ C. $T(d) = 44d + 60$ D. $T(d) = 60d + 44$
E. $T(d) = 44d - 60$
- When 30 orange trees are planted per acre each tree yields 150 oranges. For each additional tree per acre, the yield decreases by 3 oranges per tree. Express the total yield of oranges per acre, Y , as a function of the number of trees planted per acre, x , if $x \geq 30$.
A. $Y = 4500 + 60x - 3x^2$ B. $Y = \frac{1}{3}x + 80$ C. $Y = 150x - 3x^2$ D. $Y = 240x - 3x^2$
E. $Y = 900 + 3x - 60x^2$
- A manufacturer can sell dining-room tables for \$70 apiece. The manufacturer's total cost consists of a fixed overhead of \$8000 plus production costs of \$30 per table. How many tables must the manufacturer sell to break even?
A. 80 B. 267 C. 200 D. 20 E. 136
- If $f(x) = \sqrt{x+1}$ and $g(x) = x^2 + 7$ then $(f \circ g)(-1) =$
A. 0 B. 3 C. $\sqrt{7}$ D. 7 E. $\sqrt{8} + 1$
- If $f(x) = \frac{2}{x}$ then $\frac{f(x+h) - f(x)}{h} =$
A. $-\frac{2}{x^2}$ B. $\frac{2}{x+h} - \frac{2}{x}$ C. $\frac{2}{x(x+h)}$ D. $-\frac{2}{x(x+h)}$ E. $-\frac{2}{(x+h)^2}$
- The domain of $f(x) = \frac{1}{\sqrt[3]{x-1}}$ is:
A. $(-\infty, 1) \cup (1, \infty)$ B. $(1, \infty)$ C. $(0, \infty)$ D. $(-\infty, 0) \cup (0, \infty)$ E. $(-1, 1)$
- $\lim_{x \rightarrow 1} \frac{x^2 + 4x - 5}{x^2 - 1} =$
A. ∞ B. 0 C. 3 D. -3 E. 5
- $\lim_{x \rightarrow \infty} e^{-x} =$
A. 0 B. 1 C. -1 D. ∞ E. e
- Suppose

$$f(x) = \begin{cases} \frac{x^2 - 1}{x - 1} & \text{if } x < 0 \\ x^2 - 3x + 2 & \text{if } x \geq 0 \end{cases}$$

Find all values where the function f is discontinuous.
A. $x = -1$ B. $x = 0$ C. $x = 1$ D. $x = 2$ E. f is continuous for all values of x .
- Find all values of x for which the function $f(x) = 2x^3 - 3x^2 - 12x + 12$ is increasing.
A. $(-1, 2)$ B. $(\infty, -1)$ C. $(2, \infty)$ D. $(-\infty, -1) \cup (2, \infty)$ E. $(-\infty, 2) \cup (2, \infty)$

12. The derivative of $\frac{x^2 + 1}{x + 5}$ is:
 A. $\frac{x^2 + 10x - 1}{(x + 5)^2}$ B. $2x$ C. $\frac{2x^2 + 10x}{(x^2 + 1)^2}$ D. $\frac{3x^2 + 10x + 1}{(x + 5)^2}$
 E. $\frac{-x^2 - 10x + 1}{(x + 5)^2}$
13. If $y = (3 - x^2)^3$ then $y'' =$
 A. $-6x(3 - x^2)^2$ B. $24x^2(3 - x^2) - 6(3 - x^2)^2$ C. $6(3 - x^2)$
 D. $24x^2(3 - x^2)$ E. $12x^2 - 6(3 - x^2)$
14. The line tangent to the graph of $f(x) = x - \frac{1}{x}$ at $x = 2$ has slope:
 A. $\frac{5}{4}$ B. $\frac{3}{4}$ C. $\frac{3}{2}$ D. 0 E. $\frac{1}{2}$
15. Find an equation for the tangent line to the curve $x^2y + xy^3 = 2$ at the point $(1, 1)$.
 A. $2x + y = 3$ B. $3x + 4y = 7$ C. $2x + 3y = 5$ D. $5x - 2y = 3$ E. $5x + 3y = 8$
16. After t years the population of a certain town is $P(t) = 50 + 5t$ thousand people. A population P has an associated CO_2 level, $C(P) = (\sqrt{P^2 + 1})/2$. After 2 years, the rate at which CO_2 level is changing with respect to t will be:
 A. $5/(2\sqrt{5})$ B. $150/\sqrt{3601}$ C. $30\sqrt{3601}$ D. $30/\sqrt{3601}$ E. $50/\sqrt{3601}$
17. If $yx^2 + y^3 = x - y$. Then $y' =$
 A. $1 - 2xy - 3y^2$ B. $1 - 2xy - x^2 - 3y^2$ C. $(1 - 2xy)/(3y^2 + 1)$ D. $(1 - 2xy)/(x^2 + 3y^2 + 1)$
 E. $(2xy)/(x^2 + 3y^2 + 1)$
18. If the concentration $C(t)$ of a certain drug remaining in the bloodstream t minutes after it is injected is given by $C(t) = t/(5t^2 + 125)$, then the concentration is a maximum when $t =$
 A. 25 B. 15 C. 5 D. 10 E. 20
19. If $f(x) = 2x^4 - 6x^2$ then which one of the following is true?
 A. f has a relative max. at $x = \pm\sqrt{3/2}$ and a relative min. at $x = 0$.
 B. f has a relative max. at $x = 0$ and a relative min. at $x = \pm\sqrt{3/2}$.
 C. f has a relative max. at $x = -\sqrt{3/2}$ and a relative min. at $x = \sqrt{3/2}$.
 D. f has a relative max. at $x = \sqrt{3/2}$ and a relative min. at $x = -\sqrt{3/2}$.
 E. f has no relative max. points, but has relative min. at $x = \pm\sqrt{3/2}$.
20. The derivative of a function f is $f'(x) = x^2 - \frac{8}{x}$. Then at $x = 2$, f has:
 A. an inflection point B. a relative maximum C. a vertical tangent
 D. a discontinuity E. a relative minimum
21. If $f(x) = \frac{1}{3}x^3 - 9x + 2$, then on the closed interval $0 \leq x \leq 4$,
 A. f has an absolute max. at $x = 3$ and an absolute min. at $x = 0$.
 B. f has an absolute max. at $x = 4$ and an absolute min. at $x = 3$.
 C. f has an absolute max. at $x = 0$ and an absolute min. at $x = 4$.
 D. f has an absolute max. at $x = 0$ and an absolute min. at $x = 3$.
 E. f has an absolute max. at $x = 4$ and an absolute min. at $x = 0$.

22. The total cost in dollars to manufacture x units is given by the function $C = 3x^2 + x + 48$. For what value of x is the average cost a minimum?
A. 4 B. 0.17 C. 12 D. 6.93 E. 16
23. A display case is in the shape of a rectangular box with a square base. Suppose the volume is 21 cubic ft and it costs \$1 per square ft. to build the glass top and \$0.50 per sq. ft. to build the sides and base. If x is the length of one side of the base, what value should x have to minimize the cost? Round your answer to two decimal places.
A. 3.04 ft. B. 2.41 ft. C. 3.74 ft. D. 2.24 ft. E. 3.36 ft.
24. What is the area of the largest rectangle with sides parallel to the axes which can be inscribed in the first quadrant under the parabola $y = 4 - x^2$? Round your answer to 2 decimal places.
A. 1.15 B. 1.33 C. 3.08 D. 4.00 E. 2.67
25. The radius of a circular oil spill is increasing at the rate of 3 ft/min. How fast is the area increasing when the radius is 4 ft?
A. $24\pi\text{ft}^2/\text{min}$ B. $48\pi\text{ft}^2/\text{min}$ C. $8\pi\text{ft}^2/\text{min}$ D. $16\pi\text{ft}^2/\text{min}$ E. $32\pi\text{ft}^2/\text{min}$
26. Use differentials to approximate $\sqrt{3.96}$. Round your answer to 3 decimal places.
A. 1.989 B. 1.990 C. 1.980 D. 1.975 E. 1.995
27. Water is flowing into a tank which is in the shape of a right circular cylinder standing on its circular base. If the water is flowing in at a rate of 80 cu. ft. per min. and the radius of the base of the tank is 4 ft., how fast is the water rising when the water is 10 ft. deep?
A. $\frac{\pi}{5}$ ft/min B. 5π ft/min C. $\frac{50}{\pi}$ ft/min D. $\frac{5}{\pi}$ ft/min E. 50π ft/min
28. A manufacturer has been selling lamps at \$6 apiece and, at that price, consumers have been buying 3,000 lamps per month. The manufacturer wishes to raise the price and estimates that for each \$1 increase in the price, 1000 fewer lamps will be sold each month. The manufacturer can produce the lamps at a cost of \$4 per lamp. At what price should the manufacturer sell each lamp to generate the greatest possible profit?
A. \$6.25 B. \$6.50 C. \$7.00 D. \$7.50 E. \$7.75
29. A population grows exponentially. In 1960, it was 50,000 and in 1965, it was 100,000. What was the population in 1970?
A. 200,000 B. 150,000 C. 250,000 D. 300,000 E. 225,000
30. If $18^x = \sqrt{3}$, then in which of the following intervals does x lie?
A. (0, 1) B. (-1, 0) C. (1, 2) D. (-2, -1) E. (2, 3)
31. If $y = \ln \sqrt{1 - x^2}$ then $\frac{dy}{dx} =$
A. $\frac{1}{\sqrt{1 - x^2}}$ B. $-\frac{2x}{\sqrt{1 - x^2}}$ C. $-\frac{x}{1 - x^2}$ D. $\frac{1}{2(1 - x^2)}$ E. $\frac{1}{2\sqrt{1 - x^2}}$
32. The amount of a certain radioactive substance remaining after t years is given by a function of the form $Q(t) = Q_0 e^{-0.003t}$. The half-life of the substance is:
A. 53 years B. 0.00435 years C. 333 years D. 231 years E. 167 years
33. If $y = e^{x^2}$ then $\frac{dy}{dx} =$
A. e^{x^2} B. $x^2 e^{x^2 - 1}$ C. $2xe^{x^2 - 1}$ D. $2xe^{x^2}$ E. e^{2x}

34. What lump sum of money should be deposited in a money market certificate paying 8.25% interest compounded monthly to amount to 5000 in 10 years? Round your answer to the nearest dollar.
A. \$2514 B. \$4669 C. \$2740 D. \$2262 E. \$2197
35. How quickly will money double if it is invested at a rate of 8 percent compounded continuously? Round your answer to two decimal places.
A. 0.87 years B. 25 years C. 5.55 years D. 8.66 years E. 6.33 years
36. Suppose the total cost in dollars of producing q units is $C(q) = 2e^{-q} + 3q^2 - 2$. Calculate the marginal cost when 5 units have been produced and calculate the actual cost of producing the 6th unit. Round your answer to the nearest cent.
A. marginal cost = \$29.99, actual cost = \$32.99 B. marginal cost = actual cost = \$29.99
C. marginal cost = \$29.99, actual cost = \$36.00 D. marginal cost = \$30.01, actual cost = \$32.99 E. marginal cost = actual cost = \$30.01
37. The radius of a circle is 12 centimeters, with a possible error in measurement of 0.36 centimeters. Use differentials to estimate the possible error in the calculation of the area of the circle. Round your answer to two decimal places.
A. ± 27.96 cm B. ± 162.86 cm C. ± 27.14 cm D. ± 172.78 cm E. ± 27.55 cm
38. A cylindrical can with no top has been made from 27π square inches of metal. Express the volume, V , of the can as a function of its radius, r .
A. $V = 27\pi r^2$ B. $V = \frac{\pi}{2}r(27 - r^2)$ C. $V = \pi r^2(27 - r^2 - 2r)$
D. $V = 27\pi^2 r^2$ E. $V = \frac{4}{3}\pi r^2(27 - r^2)$
39. For what value of a does the function $f(x) = x^2 + ax$ have a relative minimum at $x = 1$?
A. -2 B. 0 C. 2 D. -1 E. 1
40. The total cost of manufacturing q units of a certain commodity is $C(q) = 3q^2 + 5q + 75$. At what level of production is the average cost per unit equal to the marginal cost?
A. $q = 2$ B. $q = 3$ C. $q = 4$ D. $q = 5$ E. $q = 6$

FORMULAS

Volume & Surface Area

Right Circular Cylinder

$$V = \pi r^2 h$$

$$SA = \begin{cases} 2\pi r^2 + 2\pi r h \\ \pi r^2 + 2\pi r h \end{cases}$$

Sphere

$$V = \frac{4}{3}\pi r^3$$

$$SA = 4\pi r^2$$

Interest Formulas

$$A = P\left(1 + \frac{r}{m}\right)^{mt}$$

$$A = Pe^{rt}$$

Exponential Growth & Decay

$$Q(t) = Q_0 e^{kt}$$

$$Q(t) = Q_0 e^{-kt}$$

Answers

1. B; 2. C; 3. D; 4. C; 5. B; 6. D; 7. A; 8. C; 9. A; 10. B; 11. D; 12. A; 13. B; 14. A; 15. B; 16. B; 17. D; 18. C; 19. B; 20. E; 21. D; 22. A; 23. B; 24. C; 25. A; 26. B; 27. D; 28. B; 29. A; 30. A; 31. C; 32. D; 33. D; 34. E; 35. D; 36. A; 37. C; 38. B; 39. A; 40. D.

