NAME (print): _____

SIGNATURE: _____

8 DIGIT SPIRE ID #:   ____ ____ ____ ____ ____ ____ ____ ____

CIRCLE the name of your instructor below: **Rudvalis   Sect. 1 MWF 9:05**

Pedit Sect. 2 MWF 12:200   **Cook Sect. 3 TuTh 9:30**   **Markman Sect. 4 TuTh 1:00**

DIRECTIONS: This is a 90 minute exam. It consists of 20 multiple choice questions. Your (percentage) score on this exam is 5 times the number of correct responses. Your responses must be recorded on the green "bubble" sheets using a No. 2 pencil.

You are allowed to use any kind of calculator for this exam. You are responsible for having a working calculator and knowing how to use it and also for having at least one No. 2 pencil.

YOU MAY NOT SHARE A CALCULATOR WITH ANOTHER STUDENT DURING THIS EXAM

You MAY use a one sided 8.5 x 11 page as a review sheet during the exam.

If you need more paper for work than is provided on the exam page, raise your hand and we will supply you with scratch paper. Besides the things mentioned above you may not have anything else on your desk except your ID card which will be checked when you turn in your exam.

On your green "bubble" sheet you MUST DO THE FOLLOWING:
- **WRITE your name at the top left side in the section labeled NAME and BUBBLE it in below.**
- **WRITE your 8 digit SPIRE ID in the section labeled IDENTIFICATION NUMBER in the spaces labeled A through H in the middle of the bottom left and BUBBLE it in below that.**
- **WRITE and BUBBLE in 102005 in the section labeled SPECIAL CODE.**
- **BUBBLE in your section number (1, 2 or 3) in the column labeled GRADE or EDUC.**
- **DO NOT write nor "bubble" in the sections for SEX or BIRTH DATE. (-1 pts each if you do.)**
- **Your responses to each of the 20 questions must be made by filling in the appropriate bubble on your answer sheet. In GRADING your exam the grading machine reads only the bubbles you have filled out so entering these bubbles correctly is vital to correctly recording your performance.**
- **All bubbles must be filled in solidly using a # 2 pencil in items 1-20 of the answer sheet.**

- **DO NOT LEAVE YOUR SEAT once you have started the exam until you are ready to turn it in. If you have a question or need extra paper raise your hand and we will come to you.**

1. If $f(x) = 2x^2 + x - 2$ then f(-2) is

   a) 2   b) 4   c) -2   d) 0   e) -4

2. The line with equation $4y + 2x + 12 = 0$ has

   slope, y-intercept and x-intercept, in that order, equal to:

   a) 2, 12 and 12   b) -2, 3 and -6   c) 1/2, -3 and 6

   d) -1/2, -3 and -6   e) 2, 4 and 2

3. The average rate of change of $f(x) = 2\ln(x)$ between $x = 1$ and $x = 2$ (rounded to 2 decimals) is:

   a) 1.33   b) 1.77   c) 1.27   d) 0.69   e) 1.39

4. A coffee shop sells cups of coffee for $1.50 each. Suppose the fixed cost is $10,000 and the

   variable cost is $0.10 per cup. The number of cups sold at the break even point is closest to:

   a) 5432   b) 2383   c) 6982   d) 8234   e) 7143

5. A 100 mg dose of a certain drug is metabolized by the body in a manner so that 20% of the

   remaining amount of the drug is eliminated each hour. Which of the following formulas

   best describes the amount of the drug remaining in the body after t hours?

   a) $Q_0 e^{0.2t}$ b) $100 (1.2)^t$ c) $100 (0.8)^t$ d) $20 (0.8)^t$ e) $100 (1.2)^t$

6. If the function $P(t) = 37 (0.95)^t$ is rewritten as $P(t) = P_0 e^{kt}$, then the values of P_0 and k are:

   a) $P_0 = 37$ and k = 0.051   b) $P_0 = 37$ and k = -0.051   c) $P_0 = 95$ and k = 0.05

   d) $P_0 = 9.5$ and k = -1.051   e) $P_0 = 37$ and k = .95

7. $2000 is invested in an account where 4% annual interest is compounded continuously.

   The number of years required for the value of this account to reach $10,000 is closest to:

   a) 35 years   b) 40.2 years   c) 42 years   d) 127.5 years   e) 125 years

8. If we solve the equation $4e^{2x} = \ln 2$, then to 3 significant digits x is approximately:

   a) 1.63   b) 0.881   c) 0.234   d)   0.401   e)   .876

9. Suppose I have invested my money in an account where interest is compounded continuously.

   Five years ago the value of my account was **$4200** and today the value is **$5813.**

   The interest rate r for continuous compounding for this account is closest to:

   a) 6.75%   b) 6.5%   c) 6.25%   d) 6.0%   e) 5.75%

10. The half-life of Carbon 14 is 5730 years. Assume that 100 g of Carbon 14 are present in

    the bones of a living animal and this amount decays exponentially after its death. If 10 g

    of Carbon 14 are found in the remains today, how many years ago did the animal die?

    a) 20,000   b) 18753   c) 19035   d) 17634   e) 21362

11. If the population of a certain bacteria doubles every 5 hours, how long does it take for this

    population to triple?

    a) 7.5 hrs   b) 10 hrs   c) 7.9 hrs   d) 7 hrs   e) 6.8 hrs

12. Let $f(x) = x^2$ and $g(x) = \ln(x)$. Then f(g(x)) is

    a) $\ln(x^2)$ b) $[\ln(x)]^2$ c) $x^2 \ln(x)$ d) $2 \ln(x)$ e) $\ln [\ln(x)]$

13. Measurements of a quantity w = f(t) depending on some input t give the following table:

t	0	3	6	9
w = f(t)	1	10	37	82

   Which of the following functions f(t) best describes the above table:

   a) $f(t) = 3t + 1$ b) $f(t) = t^2 + 1$ c) $f(t) = 6t + 1$ d) $f(t) = 9t + 1$ e) None of these

14. You run a chocolate chip cookie outfit and it costs $50 to produce 100 cookies. You notice
    that the increase in cost when producing 101 cookies is only 30 cents. Which of the expressions
    below best describe this observation when C(q) denotes the costs in $ for q cookies:

    a) $C(101) = 0.30$ b) $C(30) = 101$ c) $C'(100) = 50$ d. $C'(100) = 0.30$ e) $C'(100) = 50.3$

15. **The values of the distance s(t) (measured in feet) traveled by a vehicle in**

   time t (measured in seconds) are given in the following table:

t (in sec)	0	5	10	15	20	25	30
s(t) (in ft)	0	5	12	25	39	53	70

   Based on this data, the derivative s′(20) is closest to:

   a) **0.36 ft/sec**   b) **2.8 ft/sec**   c) **3 ft/sec**   d) **3.6 ft/sec**   e) **39 ft/sec**

16. **Suppose y = f(x) is a function with a continuous derivative on the interval 0   x   5**

   which also satisfies ALL the following conditions:

   f(0) > 0,   f(5) > 0,   f′ (0) < 0 and f′ (5) > 0.

   Then we can conclude:

   a) **f(x) is 0 somewhere between 0 and 5**   b) **f(x) is concave down between 0 and 5**

   c) **f′ (x) is 0 somewhere between 0 and 5**   d) **f′ (x) is zero somewhere between 0 and 5**

   e) **f is always positive between 0 and 5**

17. **Suppose you put a cup of hot tea of temperature 200° F on your table. If T = f(t)**

   describes the temperature of the tea after t minutes, what does f′(5) = -10 mean?

   a) **Temperature of the tea after 5 minutes is -10° F?**

   b) **Average rate of change of temperature of tea over 5 minutes is -10° F/minute.**

   c) **The tea will cool by approximately 10° F during the sixth minute.**

   d) **The tea will cool by approximately 10° F every minute.**

   e) **None of the above statements is correct**

18. Match the graphs of the functions f(x), g(x) and h(x) (on the left below) with the graphs of

their derivatives (on the right below) which in scrambled order are labeled r(x), s(x) and t(x).
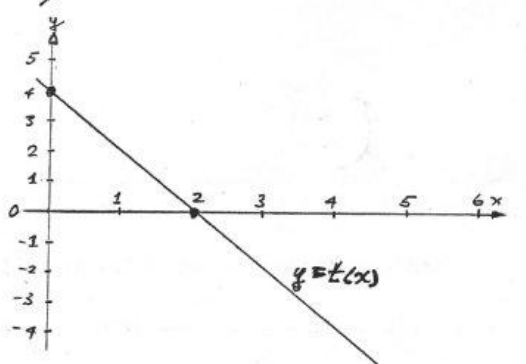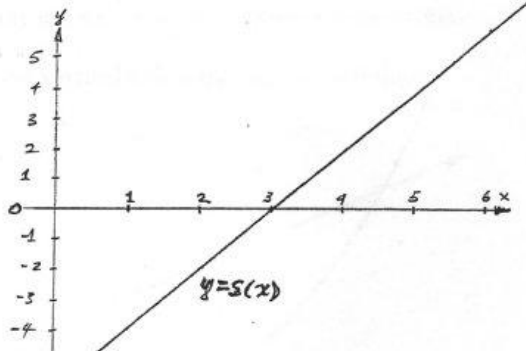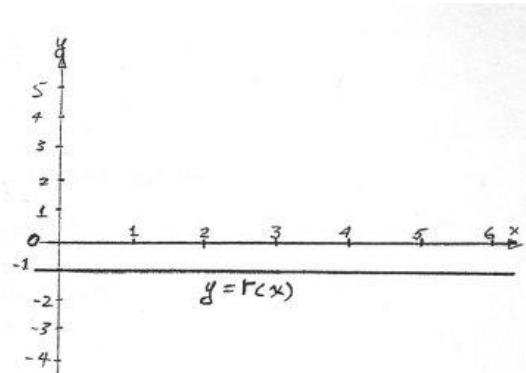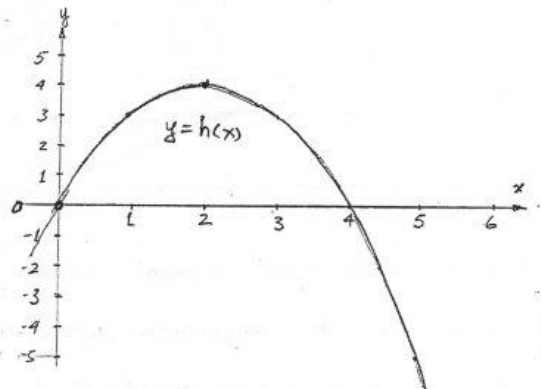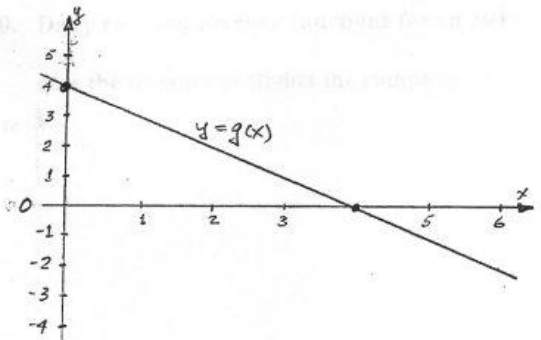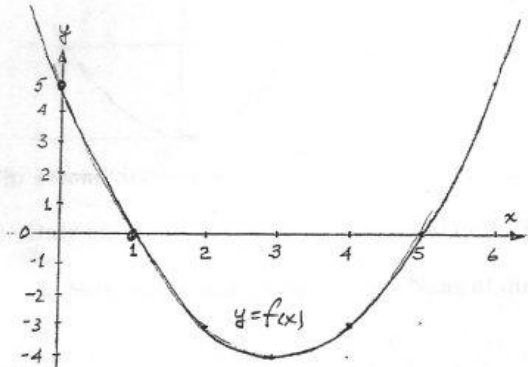
a) f′(x) = r(x), g′(x) = t(x) and h′(x) = s(x)   b) f′(x) = t(x), g′(x) = r(x) and h′(x) = s(x)

c) f′(x) = s(x), g′(x) = r(x) and h′(x) = t(x)   d) f′(x) = s(x), g′(x) = t(x) and h′(x) = r(x)

e) **None of the above is correct**

19. **The graph of the function y = f(x) is given in the figure below:**
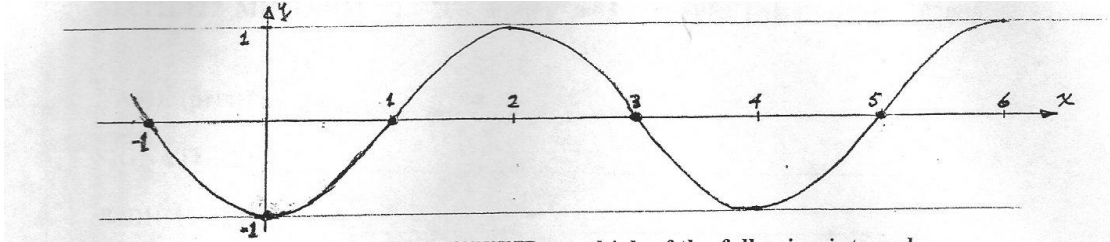
The second derivative f"(x) is POSITIVE on which of the following intervals:

a) **Only on (3, 5)**   b) **On both (0, 2) and (4, 6)**   c) **On both (-1, 1) and (3, 5)**

d) **On both (1, 3) and (5, 6)**   e) **None of the above is correct**

20. **Daily cost and revenue functions for an airline company are shown in the following figure, where**

   q is the number of flights the company operates and the vertical axis is (in millions of dollars).
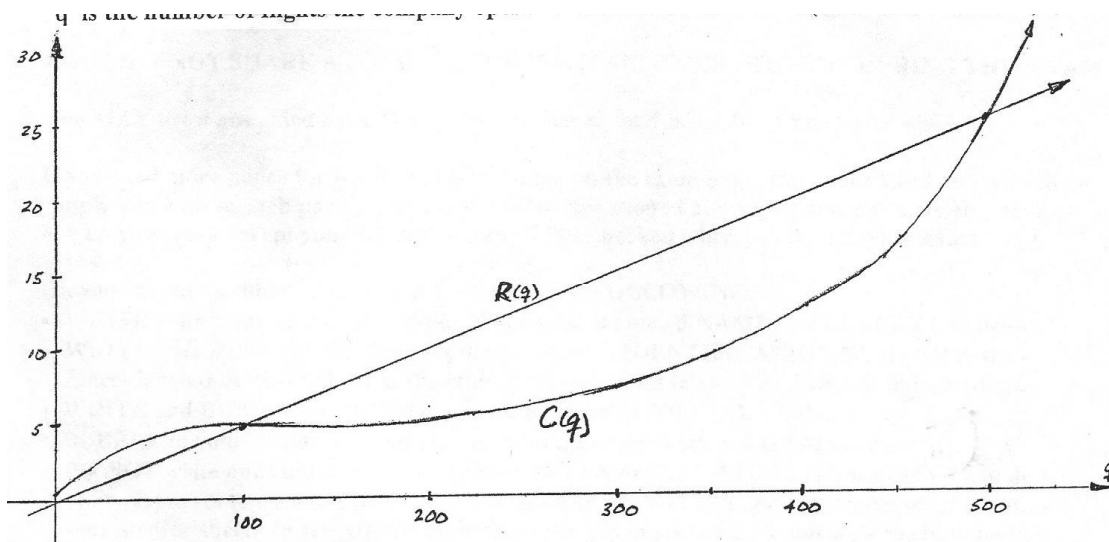
If the company operates 250 flights per day (i.e. q = 250), should it add another flight? Why?

a) **No, because the marginal cost is equal to the marginal revenue.**

b) **Yes, because the marginal revenue exceeds the marginal cost.**

c) **No, because the marginal cost exceeds the marginal revenue.**

d) **Yes, because the marginal cost exceeds the marginal revenue.**

e) **No, because the marginal revenue exceeds the marginal cost.**