Math 12, Spring 2012, Exam 1 Name: ____________________________

Open book, open notes, calculator allowed; computers and cell phones NOT allowed.

Place answers on Scantron.

(1) Which of the following is the tangent line to the curve $y = -x^2 + 3$ at $x = 2$?

(A) $y = -4(x - 2) + 1$ (B) $y = -2(x + 2) - 1$ (C) $y = -4(x + 2) - 1$ (D) $y = -4(x - 2) - 1$

(2) Which of the following is the derivative of $y = 2x^5 - x^3$?

(A) $y = 10x^4 + 3x^2$ (B) $y = 10x^4 - 3x^2$ (C) $y = 5x^4 + 3x^2$ (D) $y = 5x^4 - 3x^2$

(3) The function $g(t) = -16t^2 + 40t + 4$ gives the height in feet after t seconds of a baseball tossed upwards at the speed of 20 feet per second and released from the hand at a height of 4 feet. $g'(t)$ gives the velocity and $g''(t)$ gives the acceleration of the baseball. Then after 1 second the height, velocity, and acceleration will be:

(A) $g(2) = 20$ ft, $g'(2) = -16$ ft/sec, $g''(2) = -32$ ft/sec^2

(B) $g(2) = 20$ ft, $g'(2) = -16$ ft/sec, $g''(2) = -16$ ft/sec^2

(C) $g(2) = 20$ ft, $g'(2) = -20$ ft/sec, $g''(2) = -32$ ft/sec^2

(D) $g(2) = 20$ ft, $g'(2) = -20$ ft/sec, $g''(2) = -16$ ft/sec^2

(4) The population of Santa Cruz, California in 2000 was 56,000, and in 2010 it was 60,000. If we use an exponential function $P(t)$ to model the population growth of San Jose using these two data points, letting t be the number of years since 2000, then how many such exponential functions will have value 56,000 in year t = 0 and value 60,000 in year t = 10?

(A) None (B) One (C) Two (D) An infinite number

(5) In the previous problem, if we model the population growth with an exponential function of the form $P(t) = P_0 e^{kt}$ then k would be

(A) 1.0714 (B) .06899 (C) .006899 (D) .02996

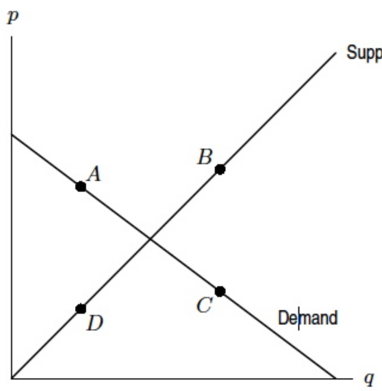
(6) In problems 4 and 5, an estimate for the population of Santa Cruz in the year 2020 would be

(A) $P(20) = (56{,}000)(1.00692)^{20}$ (B) $P(20) = (56{,}000)(1.0714)^{20}$

(C) $P(20) = (60{,}000)(1.00692)^{20}$ (D) $P(20) = (56{,}000)(1.0692)^{10}$

(7) Consider the following statements, and decide whether they are true or false:
(i) A function f cannot have both $f(a) = 0$ and $f'(a) > 0$.
(ii) If $g(x)$ is always decreasing then $g'(x)$ is always negative.

(A) (i) is true and (ii) is true (B) (i) is true and (ii) is false
(C) (i) is false and (ii) is true (D) (i) is false and (ii) is false



(8) Supply and demand curves are shown in the diagram. If a tax of $5 per item sold is imposed on the supplier, which of the points A, B, C, or D could be the new equilibrium?
(A) A (B) B (C) C (D) D

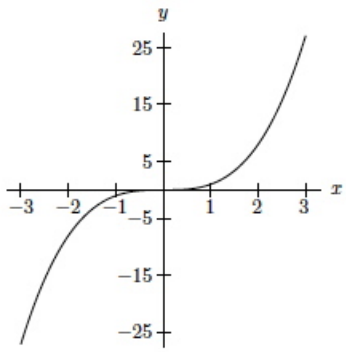
(9) Consider the following two statements:
(i) Every exponential function has a vertical intercept.
(ii) Every exponential function has a horizontal intercept.
(A) (i) is true and (ii) is true (B) (i) is true and (ii) is false
(C) (i) is false and (ii) is true (D) (i) is false and (ii) is false

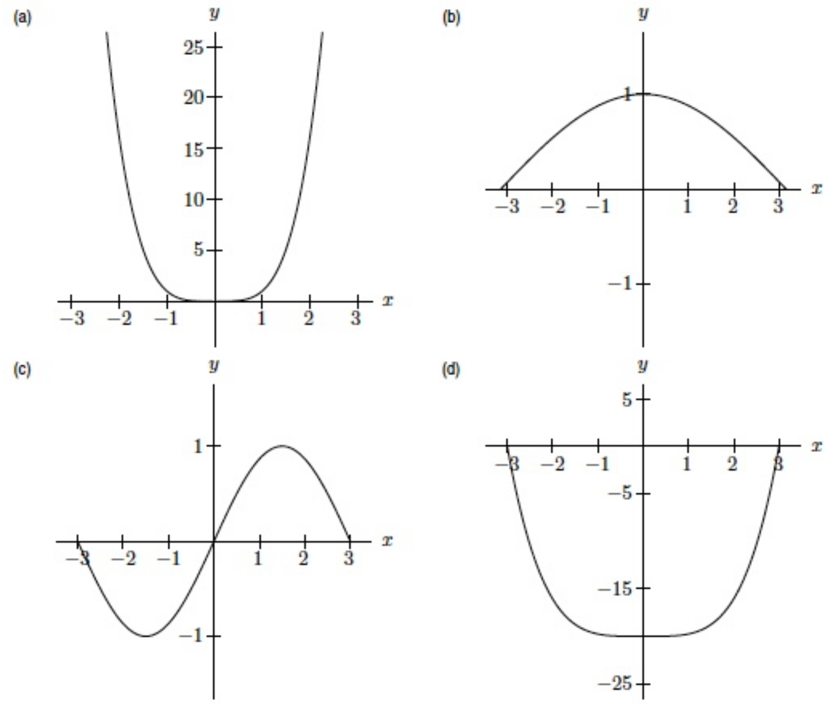
(10) Which of the following functions are decreasing and concave up?
(i) 3^{-x} (ii) 3^{x} (iii) ln x (iv) – ln x
(A) (i) and (iii) (B) (i) and (iv) (C) (i) only (D) (ii) and (iv)

(11) Solve for x if $8y = 3e^{x}$
(A) x = ln 8 + ln 3 + ln y (B) x = ln 3 – ln 8 + ln y
(C) x = ln 8 + ln y – ln 3 (D) x = ln 3 – ln 8 – ln y

(12) One quantity Q is inversely proportional to the cube root of another quantity, W. Which of the following represents this statement?
(A) $Q = W^{-1/3}$ (B) $Q = kW^{1/3}$ (C) $Q = kW^{-1/3}$ (D) $Q = kW^{3}$

(13) Which of the following graphs could be the graph whose derivative is the function on the left?





(A) (a) or (d) only (B) (b) only
(C) (c) only (D) (a) only

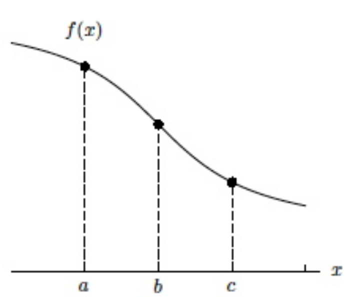
(14) Let P(t) be the population of California *t* years after 2000. Then $P'(2010)$ represents:
(A) The growth rate (in people per year) of the population.
(B) The growth rate (in percent per year) of the population.
(C) The approximate percent increase in the population in 2010.
(D) The approximate number of people by which the population increased in 2010.

(15) Consider the following statements, and decide whether they are true or false:
(i) The average rate of change of a function *f* from $a - h$ to $a + h$ is always closer to the value of the slope of *f* at *a* than is $\dfrac{f(a+h)-f(a)}{h}$.

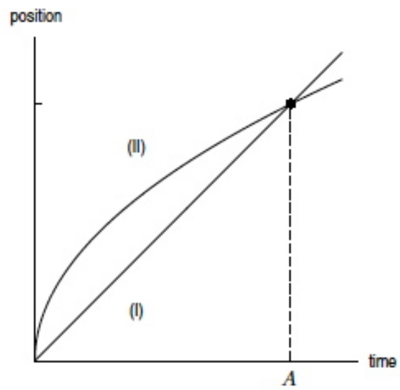
t	1.1	1.5	1.9	2.3
$r(t)$	3.7	6.6	11.1	17.1

(ii) The function $r(t)$ in the table at the right appears to have a derivative greater than 9 at t=1.9.

(A) (i) is true and (ii) is true (B) (i) is true and (ii) is false
(C) (i) is false and (ii) is true (D) (i) is false and (ii) is false



(16) The second derivative of $f(x)$ at the values $x = a, b,$ and c is (respectively, where + means positive, – means negative):
(A) +,0,– (B) –,0,+ (C) –,0,– (D) –,–,–



(17) This graph shows position as a function of time for two sprinters running in parallel lanes. Which of the following is true?
(A) At time A, both sprinters have the same velocity.
(B) Both sprinters continually increase their velocity.
(C) Both sprinters run at the same velocity at some time before A.
(D) At some time before A, both sprinters have the same acceleration.

(18) Consider the following two statements:

(i) $y = (-4x^2 - 3x + 7)(x^2 - 3x + 7)$. Then $\dfrac{d^3y}{dy^3}$ is negative for all x.

(ii) If $f'(x) = g'(x)$ for all values of x, then $f(x) = g(x)$.

(A) (i) is true and (ii) is true (B) (i) is true and (ii) is false
(C) (i) is false and (ii) is true (D) (i) is false and (ii) is false

(19) The tangent line to $y = \ln x$ may be used to approximate the value of ln(1.2). The approximation obtained this way would be:
(A) $\ln(1.2) \approx 0.0953$ (B) $\ln(1.2) \approx 1$ (C) $\ln(1.2) \approx .01$ (D) $\ln(1.2) \approx 0.1$

(20) Consider the following statements, and decide whether they are true or false:

(i) The function $f(x) = -e^x$ has $f'' < 0$ everywhere.
(ii) If $g'' > 0$ is negative at all points in an interval, then g is decreasing on that interval.

(A) (i) is true and (ii) is true (B) (i) is true and (ii) is false
(C) (i) is false and (ii) is true (D) (i) is false and (ii) is false