MAT 123 Final Exam Spring 2007 Mon., May 14, 11am-1pm

Fill in your name, student ID number, and recitation/ELC number on the lines below:

Name: _____ ID#: _____ Rec #: ____

ELC 90	Nick	TuTh	6:50p	R01	Suren	M	11:45a	R02	Hagos	Th	9:50a
R03	Rich	Tu	11:20a	R05	Deb	W	11:45a	R08	Peter	M	3:50p
R09	Jonathan	Th	9:50a	R10	Radu	Tu	11:20a	R12	Luoying	M	11:45a
R13	Luoying	W	11:45a	R14	Rich	Th	11:20a	R15	Radu	Th	11:20a

Directions: This test consists of **40** multiple-choice questions. Be sure to have 12 pages, not including this one. Write the letter of the choice (a, b, c, or d) that best answers the question or completes a statement on the answer lines below on this page. Only this page will be graded. Your work will not be evaluated for credit. At the end of the exam, you will hand in only this cover page and may keep the final exam questions.

You may not leave the exam room until 12pm at the earliest. You may *not* use a calculator or any other electronical device for this exam. You may not consult any outside resources, including fellow test-takers, notes, and textbooks. You will also not receive any information from the proctors regarding the wording of any of the exam questions. Good luck!

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

(For TA's) Score: _____

1. Which of the following equations are correct for any real numbers x and y?

I. $e^x + e^y = e^{x+y}$ II. $e^x e^y = e^{x+y}$ III. $(e^x)^y = e^{x+y}$

(a) I and II
(b) II and III
(c) II, only
(d) none

2. $\log_2(\log_3(81))$ is equal to

(a) 2
(b) 3
(c) 9
(d) 81

3. $\tan(-210^\circ)$ is equal to

(a) $\frac{1}{2}$
(b) $\sqrt{3}$
(c) $-\sqrt{3}$
(d) $-\frac{\sqrt{3}}{3}$

4. $\sin\left(\frac{3\pi}{4} + 1000\pi\right)$ is equal to

(a) $\frac{\sqrt{2}}{2}$
(b) $-\frac{\sqrt{2}}{2}$
(c) $-\frac{\sqrt{3}}{2}$
(d) $\frac{1}{2}$

5. If $\cos\theta = \frac{4}{5}$ and θ is in quadrant IV then what is the value of $\tan\theta$?

(a) $\frac{3}{5}$

(b) $-\frac{3}{4}$

(c) $-\frac{1}{5}$

(d) There is not enough information given to determine the value of $\tan\theta$

6. Which of the following is a solution of the equation $\sin\frac{x}{2} = \frac{1}{2}$?

(a) $x = \frac{\pi}{2}$

(b) $x = \frac{\pi}{6}$

(c) $x = \frac{5\pi}{6}$

(d) $x = \frac{5\pi}{3}$

7. $\cos^{-1}\left(\cos\frac{\pi}{3}\right)$ is equal to

(a) 1

(b) $\frac{\pi}{3}$

(c) $\frac{2\pi}{3}$

(d) $-\frac{1}{2}$

8. $\tan\left(\sin^{-1}\frac{\sqrt{2}}{2}\right)$ is equal to

(a) $\frac{\pi}{4}$

(b) $\sqrt{3}$

(c) $\frac{\sqrt{3}}{3}$

(d) 1

9. The graph of the function $f(x) = -3\sin(2\pi x)$ has

(a) amplitude $= 3$ and period $= 2\pi$

(b) amplitude $= 3$ and period $= 1$

(c) amplitude $= 3$ and period $= \dfrac{1}{2\pi}$

(d) amplitude $= -3$ and period $= 2\pi$

10. Which one of the following functions has a graph with both horizontal and vertical asymptotes?

(a) $f(x) = \dfrac{x^2}{x+1}$

(b) $f(x) = \dfrac{x^2}{x^2+1}$

(c) $f(x) = \dfrac{x^3+x^2-2x}{x^2+1}$

(d) $f(x) = \dfrac{1}{x-2}$

In problems **11** through **13** consider the function $g(x) = \dfrac{x^3+x}{x^2-1}$.

11. The graph of $g(x)$ has

(a) one vertical asymptote at $x = 0$

(b) two vertical asymptotes at $y = -1$ and $y = 1$

(c) two vertical asymptotes at $x = -1$ and $x = 1$

(d) no vertical asymptotes

12. As $x \to \pm\infty$, the graph of $g(x)$ approaches a slant asymptote given by the equation

(a) $y = x + 1$

(b) $y = x - 1$

(c) $y = x^2 - 1$

(d) $y = x$

13. The graph of $g(x)$ intersects the x-axis

(a) at $x = -1$ and $x = 1$

(b) at $x = 0$

(c) at $x = 0$, $x = -1$ and $x = 1$

(d) nowhere

14. The graph of the function $f(x) = -\ln(x+4)+1$ can be obtained from the graph of $g(x) = \ln(x)$ by

(a) reflecting the graph of g about the x-axis, shifting right by 4 units and shifting up by 1 unit

(b) reflecting the graph of g about the x-axis, shifting left by 4 units and shifting up by 1 unit

(c) reflecting the graph of g about the y-axis, shifting left by 4 units and shifting up by 1 unit

(d) reflecting the graph of g about the x-axis, shifting left by 4 units and shifting down by 1 unit

15. The domain of $f(x) = -\ln(x+4)+1$ is

(a) $(-\infty, \infty)$

(b) $(-\infty, 4)$

(c) $(-4, \infty)$

(d) $(-\infty, -4)$

16. Which of the following functions is everywhere decreasing and has a graph which is concave down everywhere?

(a) $f(x) = e^x$

(b) $g(x) = e^{-x}$

(c) $h(x) = -e^x$

(d) $j(x) = -e^{-x}$

17. Given that $\ln(a) = 6$ and $\ln(b) = -2$, the value of $\ln\left(\dfrac{a^2}{b^{-1}}\right)$ is

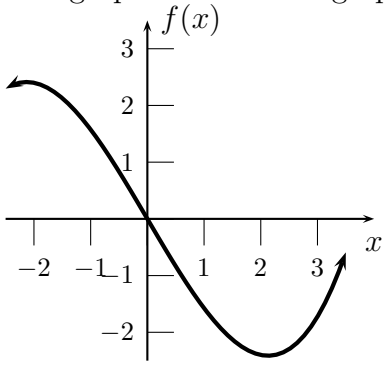
(a) 14

(b) 6

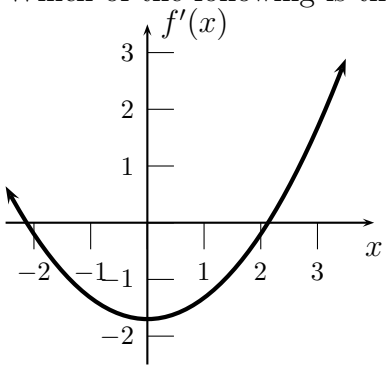
(c) 18

(d) 10

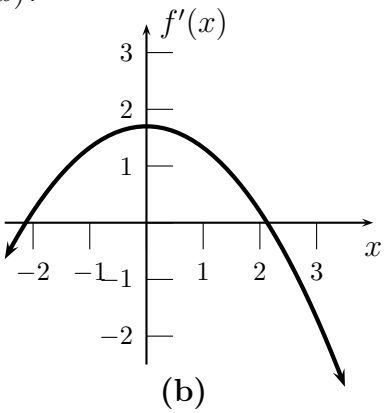
18. The graph below is the graph of a function $f(x)$.



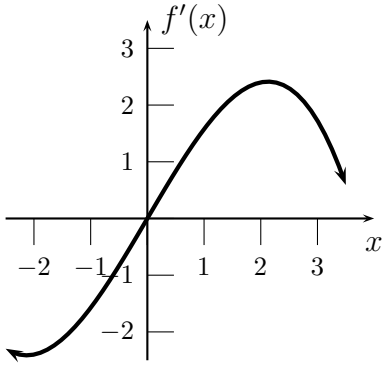
Which of the following is the graph of $f'(x)$?



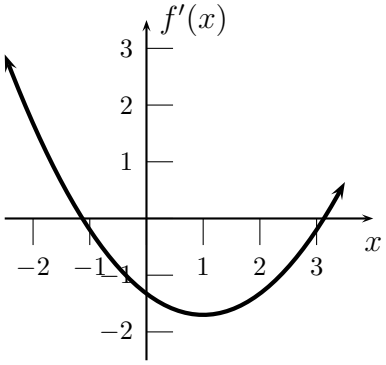
(a)



(b)



(c)



(d)

19. What is the value of $\arcsin\left(\dfrac{\sqrt{2}}{2}\right)$?

(a) $-\dfrac{\pi}{4}$

(b) $\dfrac{\pi}{6}$

(c) $\dfrac{\pi}{4}$

(d) 60°

20. If $\cos\theta = \frac{1}{2}$ and $\tan\theta > 0$, then the exact value of $\csc\theta$ is

(a) $-\frac{2}{\sqrt{3}}$

(b) 2

(c) $\frac{\sqrt{3}}{2}$

(d) $\frac{2}{\sqrt{3}}$

21. The ray connecting the origin and $(5, -12)$ determines an angle θ in standard position. What is the value of $\sin\theta$?

(a) $\frac{12}{13}$

(b) $-\frac{5}{12}$

(c) $-\frac{12}{13}$

(d) $-\frac{5}{13}$

22. What is the y-intercept of the graph of $f(x) = (3x^2 - 1)(\sin x + 1)$?

(a) -1

(b) 0

(c) 2

(d) 3

23. The solution of the equation $e^{x+2} = 7$ is

(a) $x = 7 - \ln 2$

(b) $x = \frac{7}{e} - 2$

(c) $x = \frac{7}{2} - e$

(d) $x = -2 + \ln 7$

24. Which of the following is the solution set of the equation $\ln(x) + \ln(x-1) = \ln 2$?

(a) $\{1\}$

(b) $\{-1, -2\}$

(c) $\{2\}$

(d) $\{0, 1\}$

25. If $\tan\theta < 0$ and $\sec\theta > 0$, then θ lies in quadrant

(a) I

(b) II

(c) III

(d) IV

26. The average global temperature, T, is a smooth function of time, t, in years after the year 1900 CE, so $T = f(t)$. Since 1900, the planet has been in a state of global warming, and the rate at which the planet is warming is increasing. Which of the following is true for $0 < t < 107$?

(a) $f'(t) < 0$ and $f''(t) < 0$

(b) $f'(t) > 0$ and $f''(t) < 0$

(c) $f'(t) < 0$ and $f''(t) > 0$

(d) $f'(t) > 0$ and $f''(t) > 0$

27. If $f(x) = x^2 + 2x - 10$, then $f'(x) = 2x + 2$. What is the slope of the tangent line to f at $x = 3$?

(a) 2

(b) 5

(c) 8

(d) -10

28. The derivative of the function $f(x) = -2x + 5$ is equal to

(a) 2

(b) -2

(c) 5

(d) 3

29. Suppose that $f(x)$ is a function and $f(2) = -5$. The tangent line to the graph of f at the point $(2, -5)$ also passes through the point $(4, 7)$. Then, $f'(2)$ is equal to

(a) 14

(b) 6

(c) -5

(d) 12

For questions **30** and **31**, refer to the following information:

Hurricane forecasters find it useful to track average wind speed, W, in miles per hour, during a hurricane, as a function of time, t, in minutes after the landfall of the hurricane, so $W = f(t)$. Hurricane Andrew hit Florida and passed directly over the town of Homestead, Florida. The following table gives signs for $f'(t)$ and $f''(t)$ for certain intervals of t.

Interval of t	$(0, 90)$	$(90, 100)$	$(100, 115)$	$(115, 130)$	$(130, 200)$
Sign of $f'(t)$	$+$	$+$	$-$	$-$	$+$
Sign of $f''(t)$	$+$	$-$	$-$	$+$	$+$

30. Given that $f(85) = 100$ and $f'(85) = 5$, which choice (a, b, c, or d) lists all true statements chosen from I, II, and III?

I. The wind speed 85 minutes into the storm is 100 miles/hr and that speed is increasing at a rate of 5 miles/hr per minute.

II. A reasonable estimate for $f(90)$ is 125.

III. The true value of $f(90)$ is less than 125.

(a) I, only

(b) II, only

(c) I and II, only

(d) I, II, and III

31. The eyewall of the hurricane is the most intense part of the storm, and surrounds the eye, which is a small part of the storm that yields calm weather for a brief period of time. The eye of Hurricane Andrew passed directly over Homestead. Given the information above, which is the most likely time at which Homestead experienced calm weather?

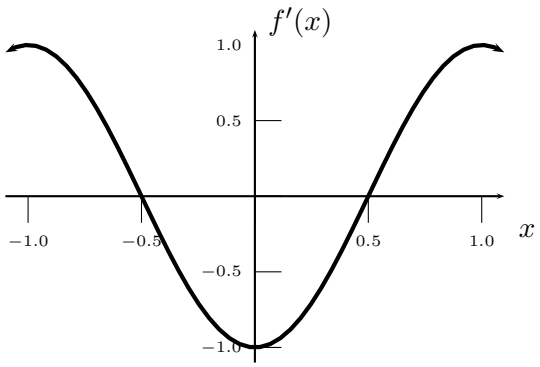
(a) 90 minutes

(b) 95 minutes

(c) 110 minutes

(d) 130 minutes

For questions **32** and **33**, refer to the graph of $f'(x)$ given below, plotted on the interval $[-1, 1]$.



32. For what x-values in the interval $[-1, 1]$ is $f(x)$ increasing?

(a) $x > 0$

(b) $-0.5 < x < 0.5$

(c) $x < -0.5$ and $x > 0.5$

(d) $f(x)$ is always decreasing.

33. For what x-values in the interval $[-1, 1]$ is the graph of $f(x)$ concave down?

(a) $x < 0$

(b) $x > 0$

(c) $-0.5 < x < 0.5$

(d) $-1 < x < 1$

34. The distance in kilometers of an object from a point is given by the function $S(t) = 4t^2$, where t is measured in hours. The average velocity of the object between $t = 1$ hour and $t = 5$ hours is

(a) 96 km/hr

(b) 24 km/hr

(c) 24 miles/hr

(d) 4 km/hr

35. The perimeter of a rectangle is 21. The area A of the rectangle, given as a function of the width, w, of the rectangle is

(a) $A(w) = w^2$

(b) $A(w) = 21w$

(c) $A(w) = w(21 - w)$

(d) $A(w) = w\left(\dfrac{21 - 2w}{2}\right)$

36. Which expression is equivalent to $f'(x)$ if $f(x) = 6\sqrt{x}$?

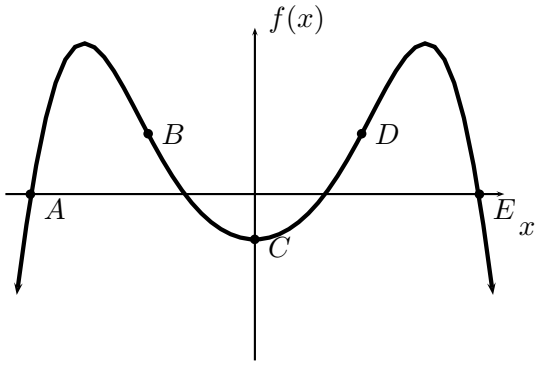
(a) $\lim\limits_{h\to 0} \dfrac{6\sqrt{h} - 6\sqrt{x}}{h}$

(b) $\lim\limits_{h\to 0} \dfrac{6\sqrt{x+h} - 6\sqrt{x}}{h}$

(c) $\lim\limits_{h\to 0} \dfrac{6\sqrt{x+h} - 6\sqrt{x}}{x}$

(d) $\lim\limits_{x\to 0} \dfrac{6\sqrt{x+h} - 6\sqrt{x}}{h}$

37. Consider the following graph of a function $f(x)$, with points labeled A through E.



Which choice lists all inflection points of f?

(a) A, E

(b) A, C, E

(c) B, C, D

(d) B, D

38. The solution of the equation $\log_x\left(\frac{1}{16}\right) = 4$ is

(a) $x = \frac{1}{4}$

(b) $x = \frac{1}{2}$ or $x = -\frac{1}{2}$

(c) $x = -2$

(d) $x = \frac{1}{2}$ only

39. $240°$ is equivalent to

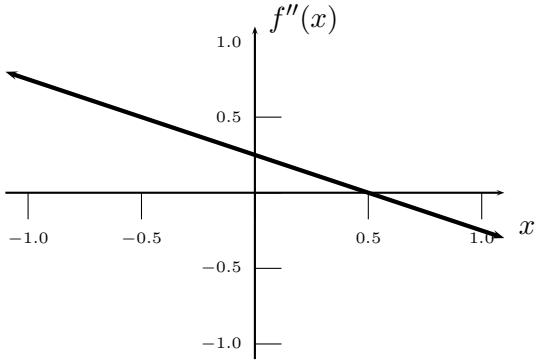
(a) $\frac{4\pi}{3}$

(b) $\frac{7\pi}{6}$

(c) $\frac{5\pi}{6}$

(d) $-\frac{5\pi}{6}$

40. The following is a graph of $f''(x)$.



Which statement is **false**?

(a) The graph of $f(x)$ is concave up on the interval $\left(-\infty, \frac{1}{2}\right)$.

(b) $f'(x)$ is decreasing on the interval $\left(\frac{1}{2}, \infty\right)$.

(c) The graph of $f(x)$ must have two inflection points.

(d) $f''(x)$ is decreasing on the interval $\left(-\infty, \frac{1}{2}\right)$.

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