Name: _____

Instructor: _____

Math 125, Final

December 16, 1998

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- Be sure that you have all 15 pages of the test.
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- The exam lasts for two hours.
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Good Luck!

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1.	(a)	(b)	(c)	(d)	(e)	16.	(a)	(b)	(c)	(d)	(e)
2.	(a)	(b)	(c)	(d)	(e)	17.	(a)	(b)	(c)	(d)	(e)
3.	(a)	(b)	(c)	(d)	(e)	18.	(a)	(b)	(c)	(d)	(e)
4.	(a)	(b)	(c)	(d)	(e)	19.	(a)	(b)	(c)	(d)	(e)
5.	(a)	(b)	(c)	(d)	(e)	20.	(a)	(b)	(c)	(d)	(e)
6.	(a)	(b)	(c)	(d)	(e)	21.	(a)	(b)	(c)	(d)	(e)
7.	(a)	(b)	(c)	(d)	(e)	22.	(a)	(b)	(c)	(d)	(e)
8.	(a)	(b)	(c)	(d)	(e)	23.	(a)	(b)	(c)	(d)	(e)
9.	(a)	(b)	(c)	(d)	(e)	24.	(a)	(b)	(c)	(d)	(e)
10.	(a)	(b)	(c)	(d)	(e)	25.	(a)	(b)	(c)	(d)	(e)
11.	(a)	(b)	(c)	(d)	(e)						
12.	(a)	(b)	(c)	(d)	(e)						
13.	(a)	(b)	(c)	(d)	(e)						
14.	(a)	(b)	(c)	(d)	(e)						
15.	(a)	(b)	(c)	(d)	(e)						

Score: _____

1.(6 pts.)

$$\lim_{w\to\infty} \frac{w^3+3w}{w^5+5w^3} =$$

(a) $\frac{3}{5}$ (b) ∞ (c) 0 (d) $\frac{5}{3}$ (e) $-\infty$

2.(6 pts.) Which choice below completes the next phrase to a true sentence? The function $f(x) = |\sin(x)|$ is

(a) differentiable everywhere.

(b) differentiable except at integer multiples of π.

(c) differentiable nowhere.

(d) continuous except at integer multiples of π

(e) continuous only at integer multiples of π.

3.(6 pts.) If $y = \displaystyle\int_0^x \sec w \; dw$, for $-\frac{\pi}{2} < x < \frac{\pi}{2}$, then $\dfrac{d^2y}{dx^2} =$

(a) $\sec x \tan x$ (b) $\cos x$ (c) $\sec x$

(d) $\tan x$ (e) The second derivative does not exist.

4.(6 pts.) If

$$x^4 + y^4 = 8xy + y \ ,$$

find $\dfrac{dy}{dx}$ at the point $(2, 1)$.

(a) It does not exist. (b) It may exist but it can not be determined.

(c) 0 (d) $\dfrac{24}{13}$

(e) $\dfrac{17}{19}$

5.(6 pts.) Suppose f and h are two functions which are differentiable at 8. If $f(8) = 2$, $f'(8) = 5$, $h(8) = 3$ and $h'(8) = 7$. Let $F(x) = f\big(h(x)\big)$. Then $F'(8) \ = \ ?$

(a) 35 (b) 14

(c) 42 (d) 15

(e) Can not be determined from the above data.

6.(6 pts.) The value of $\displaystyle\int_1^2 \frac{dx}{x}$ is 0.6931 to two decimal places. Which number below best approximates $\displaystyle\int_0^1 \frac{x}{x^2+1}\,dx$?

(a) 0.6931 (b) 2.7724 (c) 0.1732 (d) 1.3862 (e) 0.3465

7.(6 pts.)

$$\frac{d\,(1+x^2-x^3)^{37}}{dx} = ?$$

(a) $\dfrac{(1+x^2-x^3))^{38}}{38}$

(b) $37(1+x^2-x^3))^{36}$

(c) $\dfrac{(1+x^2-x^3))^{38}}{38(2x-3x^2)}$

(d) $37(1+x^2-x^3))^{36}(2x-3x^2)$

(e) $\dfrac{(1+x^2-x^3))^{38}(2x-3x^2)}{38}$

8.(6 pts.) The absolute maximum of the function $x+\dfrac{1}{2x^2}$ on the interval $[\frac{1}{4},4]$ is

(a) $8\dfrac{1}{4}$

(b) $\dfrac{3}{2}$

(c) $2\dfrac{1}{8}$

(d) $4\dfrac{1}{32}$

(e) The function has no absolute maximum.

=:problem09:function.ps

9. (6 pts) Suppose that the graph below is the graph of the function $f(x)$. Which graph below best represents the graph of the function $\int_0^x f(t)\,dt$?

=:problem09:b.ps

(a)

=:problem09:d.ps

(b)

=:problem09:c.ps

(c)

=:problem09:e.ps

(d)

=:problem09:ans.ps

(e)

10.(6 pts.) What are the asymptotes (both vertical and horizontal) for the graph of

$$y = \frac{1 - 4x^2}{(x-3)(x+2)} \quad ?$$

(a) There are no asymptotes

(b) $x = 3$ and $y = \pm\dfrac{1}{2}$

(c) $x = \dfrac{1}{2}$, $y = 3$ and $y = -2$

(d) $y = -4$, $x = 3$ and $x = -2$

(e) $y = \pm\dfrac{1}{2}$, $x = 3$ and $x = -2$

11.(6 pts.) Where does the linearization of the function $f(x) = 3x^3 - 12$ at $x = 2$ cross the x axis?

(a) $x = \sqrt[3]{4}$

(b) $x = \dfrac{5}{3}$

(c) $x = 2$

(d) $x = \dfrac{7}{4}$

(e) Never.

12.(6 pts.) How many inflection points does the curve $y = 3x^4 - 4x^3 - 3$ have?

(a) 2 (b) 4 (c) 3 (d) 1 (e) None

13.(6 pts.) How many solutions in real numbers does the equation $3x^4 - 4x^3 - 3 = 0$ have? Hints: The function is the same as the function in #12. You might also want to consider where the function is increasing/decreasing.

(a) 3 (b) 1 (c) None (d) 4 (e) 2

14.(6 pts.) Which function below is a solution to the initial value problem

$$y' = \sin(\sqrt{x}\,) \quad \text{and} \quad y(2) = 4\ ?$$

(a) $4 + \displaystyle\int_2^x \sin(\sqrt{t}\,)\,dt$

(b) $4 + \displaystyle\int_2^{\sqrt{x}} \sin t\,dt$

(c) $4 + \displaystyle\int_0^x \sin(\sqrt{t}\,)\,dt$

(d) $\cos(\sqrt{x}\,) + 4 - \cos(\sqrt{2}\,)$

(e) $\cos(\sqrt{x}\,) + 4$

15.(6 pts.) The value of $\displaystyle\int_0^1 \frac{3x^2+3}{(x^3+3x+4)^2}\,dx$ is

(a) $\dfrac{1}{8}$ (b) $\dfrac{1}{4}$ (c) 8 (d) $-\dfrac{1}{4}$ (e) 4

16.(6 pts.) Find the value of c for which $f(c)$ is the average value of f for the function $f(x) = x^2$ on the interval $[0, 6]$.

(a) $2\sqrt{3}$ (b) 3 (c) There is no c in the interval $[0, 3]$.

(d) $\sqrt{6}$ (e) $\sqrt{3}$

17.(6 pts.) About how accurately should you measure a variable t to insure that your calculation of the area of the rectangle with sides $a = t$, and $b = 3t$ is within 5% of its true value?

(a) 5% (b) 3.5% (c) .05% (d) 2.5% (e) 200%

18.(6 pts.) You are to plan a road between two towns, A and B, separated by a canyon. You decide to build a bridge from town A to some point on the opposite edge of the canyon, and then run the road along the edge of the canyon to town B. Naturally, it costs more to build the bridge than the road along the rim. Specifically, it costs \$5 per unit distance to build the bridge verses \$3 per unit distance to build along the rim. The canyon is 12 units wide and it is 20 units from one town to the point on the edge opposite the other. What value of x in the graph below will minimize the cost?

=4in :problem18:Bridge.ps

(a) 10 (b) 20 (c) 12

(d) 8 (e) 9

19.(6 pts.) A lighthouse has a searchlight that rotates clockwise at a constant speed of 0.6 radians per second: $\frac{d\theta}{dt} = 0.6$. The light is a mile offshore. How fast does the light appear to be moving across the beach at the point closest to the light in miles per second?

=4in :problem19:lighthouse.ps

(a) $\frac{\pi}{6}$ (b) 0.6 (c) 0.3π (d) 0.36 (e) 1.6

20.(6 pts.) The two curves $y = 16 - x^4$ and $y = 4 - x^2$ enclose a bounded region. Which integral computes its area?

(a) $\int_{-2}^{2} \left((16 - x^4)^2 - (4 - x^2)^2\right)\, dx$ (b) $\int_{-2}^{2} (x^4 - x^2 - 12)\, dx$

(c) $\int_{-2}^{2} 20 + x^2 + x^4\, dx$ (d) $\int_{-2}^{2} (12 + x^2 - x^4)\, dx$

(e) $\int_{-2}^{2} 20 - x^2 - x^4\, dx$

21.(6 pts.) Consider a solid in space which is sliced by planes perpendicular to the x axis. The base of the solid is in the yz plane. At distance $x > 0$ from the yz plane, the slice is a disk of radius $\sqrt{1-x^4}$. Which integral below computes the volume?

(a) $2\pi \int_0^1 \sqrt{1-x^4}\, dx$

(b) $\int_0^1 (1+x^4)\, dx$

(c) $\pi \int_0^1 (1-x^4)\, dx$

(d) $\pi \int_0^1 x\sqrt{1-x^4}\, dx$

(e) $\pi \int_0^1 x(1-x^4)\, dx$

22.(6 pts.) Consider the region in the plane bounded by the two curves $y = 4 + \sqrt{4-x^2}$ and $y = x^2$. Rotate this region about the x axis. Which integral below computes the resulting volume?

(a) $\pi \int_{-1}^1 \big((x^2)^2 - (4+\sqrt{4-x^2}\,)^2\big)\, dx$

(b) $\pi \int_{-1}^1 \big((4+\sqrt{4-x^2}\,)^2 - (x^2)^2\big)\, dx$

(c) $\pi \int_{-2}^2 \big((4+\sqrt{4-x^2}\,)^2 - (x^2)^2\big)\, dx$

(d) $\pi \int_{-2}^2 \big((x^2)^2 - (4+\sqrt{4-x^2}\,)^2\big)\, dx$

(e) $2\pi \int_0^2 x\big(4+\sqrt{4-x^2} - x^2\big)\, dx$

23.(6 pts.) Consider the region in the first quadrant bounded by the lines $y = x + 2$ and $x = 4$. Rotate this region around the y axis. Which integral below computes the volume of the resulting solid of revolution?

(a) $2\pi \int_0^6 y(4 - y)\, dy$

(b) $2\pi \int_0^4 x(x + 2)\, dx$

(c) $2\pi \int_0^4 x(2 - x)\, dx$

(d) $\pi \int_0^4 \left(4^2 - (x + 2)^2\right) dx$

(e) $2\pi \int_0^4 4(x + 2)\, dx$

24.(6 pts.) Which integral below gives the arc length of the graph of the curve $x = \sqrt{8 - 2y^2}$ from $y = 0$ to $y = 2$?

(a) $\int_0^2 \sqrt{9 - 2y^2}\, dy$

(b) $\int_0^2 \sqrt{1 + \dfrac{1}{8 - 2y^2}}\, dy$

(c) $\int_0^2 \sqrt{\dfrac{8 + 2y^2}{8 - 2y^2}}\, dy$

(d) $\int_0^2 \dfrac{2y}{\sqrt{8 - 2y^2}}\, dy$

(e) $\int_0^2 \sqrt{\dfrac{8 + 2y^2}{\sqrt{8 - 2y^2}}}\, dy$

25.(6 pts.) Consider the graph of the function $y = x^3$ from $x = 0$ to $x = 2$. Rotate this curve around the x axis. Which integral below gives the surface area of the resulting solid of revolution?

(a) $2\pi \int_0^2 (x^3)(3x^2)\, dx$

(b) $2\pi \int_0^8 y\sqrt{1+y^2}\, dy$

(c) $2\pi \int_0^2 (x^3)\sqrt{1+9x^4}\, dx$

(d) $2\pi \int_0^2 x\, x^3\, dx$

(e) $\pi \int_0^2 (x^3)^2\, dx$

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