1.(6 pts.) Compute $\lim_{x\to 2^-} \dfrac{x^2-4}{x^2-5x+6}$.

(a) -4 (b) ∞ (c) 0 (d) $-\infty$ (e) 1

2.(6 pts.) Compute $\lim_{x\to 0^+} \dfrac{x^2-9}{\sin x}$.

(a) $-\infty$ (b) -9

(c) 0 (d) ∞

(e) Does not exist and is not ∞ or $-\infty$.

3.(6 pts.) Evaluate $\lim_{x\to\infty} (\sqrt{x^2-x} - \sqrt{x^2+5x}\,)$.

(a) -3 (b) 0 (c) 3

(d) -6 (e) Does not exist

4.(6 pts.) For what constant a is the function f given by

$$f(x) = \begin{cases} ax+1 & x<0 \\ x^2+1 & x\geq 0 \end{cases}$$

differentiable everywhere?

(a) $a=0$ (b) $a=1$

(c) $a=2$ (d) Any value of a

(e) No value of a

5.(6 pts.) Compute $\lim_{x\to 0} \dfrac{\tan 2x}{\sin 3x}$.

(a) $2/3$ (b) 1 (c) 0 (d) 2 (e) $1/3$

6.(6 pts.) Compute $\lim_{x\to-\infty} \dfrac{\sqrt{4x^2+x+1}}{3x-1}$.

(a) $-2/3$ (b) $2/3$ (c) $1/3$ (d) $-1/3$ (e) 0

7.(6 pts.) Compute the tangent line to the ellipse given by the equation $x^2 + 4y^2 = 5$ at the point $(1, -1)$

(a) $y = \frac{1}{4}x - \frac{5}{4}$ (b) $y = \frac{1}{4}x - \frac{3}{4}$

(c) $y = -\frac{1}{4}x - \frac{3}{4}$ (d) $y = \frac{1}{2}x - \frac{3}{2}$

(e) The tangent line does not exist.

8.(6 pts.) Let $F(x) = f(g(x))$. Compute $F'(2)$ using the following information:
$f(-1) = -3$, $f(2) = 12$, $g(-1) = -7$, $g(2) = -1$,
$f'(-1) = 2$, $f'(2) = 8$, $g'(-1) = -1$, $g'(2) = 5$.

(a) 10 (b) -15 (c) 40 (d) 2 (e) 52

9.(6 pts.) For $y = (\sin 4x)^8$, compute y'.

(a) $32(\sin 4x)^7 \cos 4x$ (b) $32(\sin 4x)^7$

(c) $8(\sin 4x)^7$ (d) $8(\cos 4x)^7$

(e) $32(\cos 4x)^7$

10.(6 pts.) How many inflection points does the curve $y = \frac{x^5}{5} + \frac{x^4}{4}$ have?

(a) 1 (b) 2 (c) 3 (d) 4 (e) 0

11.(6 pts.) Compute the derivative y' for the curve $\sqrt{x^2 + y^2} = 2 + y$ at the point $x = 4$, $y = 3$.

(a) 2 (b) 0 (c) -2 (d) $-2/11$ (e) $2/11$

12.(6 pts.) A kite 100 ft above the ground is flying horizontally (away from its holder) with a speed of 16ft/sec. At what rate is the angle between the string and the horizontal direction changing, when 200 ft of the string have been let out?

(a) $-\frac{1}{25}$ radian/second (b) $\frac{1}{50}$ radian/second

(c) $\frac{\pi}{50}$ radian/second (d) $-\frac{1}{50}$ radian/second

(e) $\frac{1}{25}$ radian/second

13.(6 pts.) Find the linearization of $f(x) = \sqrt{10 - x^2}$ at $a = -1$.

(a) $L(x) = \frac{1}{3}(x+1) + 3$

(b) $L(x) = -\frac{1}{3}(x+1) + 3$

(c) $L(x) = \frac{2}{3}(x+1) + 3$

(d) $L(x) = -\frac{2}{3}(x+1) + 3$

(e) $L(x) = x + 4$

14.(6 pts.) Find all local maxima and minima of the function $f(x) = 2|x| - x^2 - 1$.

(a) Local maxima: $(x, y) = (-1, 0)$ and $(x, y) = (1, 0)$, local minimum $(x, y) = (0, -1)$.

(b) Local maximum: $(x, y) = (-1, 0)$, local minimum $(x, y) = (0, -1)$.

(c) Local maxima: $(x, y) = (-1, 0)$ and $(x, y) = (1, 0)$, no local minimum.

(d) No local maxima or minima, because the function $|x|$ has no derivative at $x = 0$.

(e) Only local minimum at $(x, y) = (0, -1)$, no local maxima.

15.(6 pts.) Find all asymptotes of the curve $y = \dfrac{2x^2 + x + 1}{x - 1}$.

(a) slant asymptote $y = 2x + 3$, vertical asymptote $x = 1$, no horizontal asymptotes.

(b) horizontal asymptotes $y = 2$, vertical asymptote $x = 1$, no slant asymptotes.

(c) horizontal asymptotes $y = 2$, slant asymptote $y = 2x + 3$, no vertical asymptotes.

(d) slant asymptote $y = 2x + 1$, vertical asymptote $x = 1$, no horizontal asymptotes.

(e) vertical asymptote $x = 1$, no other asymptotes.

16.(6 pts.) Find **all** the points on the hyperbola $y^2 - x^2 = 4$ that are closest to the point $(2, 0)$.

(a) $(1, \pm\sqrt{5})$

(b) $(\sqrt{5}, 1)$

(c) $(1, \pm 5)$

(d) $(-1, \sqrt{5})$

(e) $(1, \sqrt{5})$

17.(6 pts.) A page of a book is to have a total area of 150 square inches, with 1 inch margins at the top and sides, and a 2 inch margin at the bottom. Find the dimensions in inches of the page which will have the largest print area.

(a) 10×15 (b) $11\frac{7}{13} \times 13$ (c) $5\sqrt{3} \times \frac{30}{\sqrt{3}}$

(d) $3\sqrt{7} \times \frac{50}{\sqrt{7}}$ (e) 5×30

18.(6 pts.) Newton's method is to be used to find a root of the equation

$$x^3 - x - 1 = 0.$$

If $x_1 = 1$, find x_2.

(a) 1.50 (b) 1.35 (c) 1.75 (d) 3 (e) 0.95

19.(6 pts.) Express the limit below as a definite integral.

$$\lim_{n\to\infty} \sum_{i=1}^{n} \frac{\pi}{4n} \sec^2\left(\frac{i\pi}{4n}\right)$$

(a) $\int_0^{\pi/4} \sec^2(x)dx$ (b) $\int_0^{\pi/2} \sec^2(x)dx$

(c) $\int_0^{\pi/4} \sec^2\left(\frac{\pi}{4}\right)dx$ (d) $\frac{\pi}{4}\int_0^{\pi/4} \sec^2(x)dx$

(e) $\int_0^{1} \sec^2\left(\frac{\pi}{4}x\right)dx$

20.(6 pts.) If $f(x) = \int_0^{5x} \cos(u^2)du$, find $f'(x)$.

(a) $5\cos(25x^2)$ (b) $-25\cos(5x^2)$ (c) $-\cos(5x^2)$

(d) $5\cos(5x^2)$ (e) $-5\cos(25x^2)$

21.(6 pts.) Evaluate the integral $\int_0^{\sqrt{\pi}} x\sin(x^2)dx$.

(a) 1 (b) $\frac{1}{4}$ (c) 2 (d) $1 - \frac{1}{\pi}$ (e) $\frac{\pi}{4}$

22.(6 pts.) Which of the following integrals give the area of the region below the curve $y = 2x$ and above the curve $y = x^2 - 4x$?

(a) $\displaystyle\int_0^6 \Big(2x - (x^2 - 4x)\Big)dx$

(b) $\displaystyle\int_0^6 \Big((x^2 - 4x) - 2x\Big)dx$

(c) $\displaystyle\int_0^4 \Big(2x - (x^2 - 4x)\Big)dx + \int_4^6 \Big((x^2 - 4x) - 2x\Big)dx$

(d) $\displaystyle\int_0^4 \Big((x^2 - 4x) - 2x\Big)dx$

(e) $\displaystyle\int_0^4 \Big(2x - (x^2 - 4x)\Big)dx$

23.(6 pts.) An area in xy plane bounded by the curves $y = 0$ and $y = x - x^2$. If we rotate this area about $x = 7$, which integral below gives the volume?

(a) $\displaystyle 2\pi \int_0^1 (7 - x)(x - x^2)\ dx$

(b) $\displaystyle \pi \int_0^1 (x - x^2)^2\ dx$

(c) $\displaystyle 2\pi \int_0^1 (x - 7)(x - x^2)dx$

(d) $\displaystyle \pi \int_0^{1/4} (x - x^2)^2\ dx$

(e) $\displaystyle 2\pi \int_0^{\pi} (x - x^2 - 7)\ dx$

24.(6 pts.) The plane region bounded by the curves $y = 2$ and $y = 2 + 2x - x^2$ is rotated about the x axis. Which integral below gives the volume?

(a) $\displaystyle \pi \int_0^2 \Big((2 + 2x - x^2)^2 - 4\Big)dx$

(b) $\displaystyle \pi \int_0^2 \Big(4 - (2 + 2x - x^2)^2\Big)\ dx$

(c) $\displaystyle \pi \int_0^1 \Big((2 + 2x - x^2)^2 - 4\Big)dx$

(d) $\displaystyle \pi \int_0^1 \Big(4 - (2 + 2x - x^2)^2\Big)\ dx$

(e) $\displaystyle 2\pi \int_0^2 \Big((2 + 2x - x^2) - 2\Big)dx$

25.(6 pts.) The function $f(x) = \sqrt{16 - 2x}$ is continuous on the interval $[0, 8]$. Which number below is its average value on this interval?

(a) $\frac{8}{3}$ (b) $\frac{16}{3}$ (c) $-\frac{8}{3}$

(d) $\frac{64}{3}$ (e) $\frac{8}{3}\sqrt{8}$