1. *Polynomials and Radicals*

   (a) Derivatives: Compute $f'(x)$ of the following

      i. $f(x) = 6x^2 - 12x + 1$

      ii. $f(x) = 7x^{-2} + 12x^{-3} + 11$

      iii. $f(x) = 8x^{1/2} - 12x^{-3/2} + 10$

      iv. $f(x) = 6\sqrt{x} + 12x^{-3/2} - 12$

      v. $f(x) = (x^3 - 12x)(1 + 2x + 3x^2)$

      vi.
$$f(x) = \frac{(2x^2 - 12x)}{(1 + 2x)}$$

i. $f(x) = (3x + 1)^4$

ii. $f(x) = (1 - 2x)^{-4}$

(a) Integrals: Compute $\int f(x)dx$

i. $f(x) = 6x^2 + 12x + 1$ Compute $\int_2^f (x)dx$

ii. $f(x) = 7x^{-2} + 12x^{-3} + 11$

iii. $f(x) = 8x^{1/2} - 12x^{-3/2} + 10$

i. $f(x) = (2x+1)^4$

ii. *Compute* $\int_1^3 \sqrt{3x+1}dx$

iii. $f(x) = x(3x^2+1)$

(a) Applications

i. Find the speed of a pebble the instant it hits the ground if it is dropped from 256 feet high.

ii. Find the velocity at $t = 2$ of an object whose position is $s(t) = x(3x + 1)^2$ feet high at time t (in seconds).

iii. Find the area bound by $y = x^3 + 2$ and $y = x^4$. Sketch the region.

iv. Find the volume of the solid obtained by rotating the region bounded by

$$y = 3x^2, y = 0, x = 0, x = 1$$

about the y-axis.

v. Find the volume of the solid obtained by rotating the region bounded by

$$y = 3x^2, y = 0, x = 0, x = 1$$

about the x-axis.

vi. Find the average velocity of a projectile whose velocity in $(\frac{ft}{sec})$ is given by $v(t) = \cos(2t)$ where t is measured in seconds and $t \in [0, 2\pi]$.

vii. A rectangular box with a square base and open top is to be made. If 1000 cm^2 of material is available, what is the largest volume that can be made?

2. *Exponentials*

   (a) Derivatives: Compute $f'(x)$ of the following

      i. $f(x) = e^{2x+1}$

      ii. $f(x) = e^{-3x^2+x}$

      iii. $f(x) = 2e^{\cos(x)}$

      iv. $f(x) = xe^x$

      v. $f(x) = 2xe^{3x}$

      vi.

$$f(x) = \frac{2x+1}{e^{3x}}$$

(a) Integrals

i. *Compute* $\int_1^3 f(x) = e^{2x} dx$

ii. $f(x) = e^{-3x}$

i. $f(x) = e^{2x+1}$

ii. $f(x) = xe^{2x^2+1}$

iii. $f(x) = \cos(x)e^{\sin(x)}$

iv. $f(x) = \sin(x)e^{2\cos(x)+1}$

i. $f(x) = xe^x$

ii. $f(x) = -xe^{2x}$

iii. $f(x) = 5xe^{-2x}$

(a) Applications

i. Find the velocity at $t = 5$ of an object moving according to $s(t) = x(e^{-x})$

ii. Find the height at $t = 10$ of a bottle rocket whose velocity is $v(t) = x(e^{-x})$, where $t = 0$ corresponds to the moment of liftoff.

iii. Kyle, who likes guns, fires a bullet straight up into the air. How high does the bullet go? Ignore air resistence, assume the initial velocity of the bullet is 400 feet per second, and assume gravity is $-32\frac{feet}{sec}$.

3. *Logarithmic Functions*

(a) Derivatives: Compute $f'(x)$ of the following

i. $f(x) = \ln(cos(x))$

ii. $f(x) = \ln(2x)$

iii. $f(x) = x \ln(x)$

iv. $f(x) = 2x \ln(3x)$

v.

$$f(x) = \frac{\ln x}{3x}$$

vi.

$$f(x) = \frac{2x}{\ln x + 1}$$

(a) Integrals

i.

$$f(x) = \frac{1}{x}$$

ii.

$$f(x) = \frac{\sin(x)}{\cos(x)}$$

iii.

$$f(x) = \frac{x^2}{x^3 + 1}$$

(a) Applications

i. Suppose the height of an object is given by $f(x) = \ln(x)$. Which is greater, the speed of the object at $t = 10$ or $t = 100$? Is the object going up or down? Is the object accelerating or deccelerating at these times?

4. *Trigonometric Functions*

(a) Derivatives: Compute $f'(x)$ of the following

i. $f(x) = \cos 2x$

ii. $f(x) = \tan x$

iii. $f(x) = \sin(3x)e^{2x}$

iv.

$$f(x) = \frac{1}{\sin x}$$

v. $f(x) = \cos 2x^3 + x$

vi. $f(x) = \sin e^{2x}$

vii. $f(x) = (1 + \sin 2x)^3$

viii. $f(x) = x \cos x$

(a) Integrals

i. $f(x) = \sin 2x$

ii. $f(x) = \cos(-2x)$

i. $f(x) = x\cos(-2x^2)$

ii. $f(x) = x^2\sin(-2x^3)$

iii. $f(x) = \sin(x)(1 + \cos x)^3$

i. $f(x) = x\sin((x))$

ii. $f(x) = 2x^2\cos((3x))$

(a) Applications

i. Find the velocity at time $t = 3$ of an object whose position whose position is

$$s(t) = 2\cos(1.3x - 2)$$

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ii. Find the acceleration at time $t = 10$ of an object whose position is given by

$$s(t) = 2\cos(1.3x - 2)$$

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