1. The equation of the line passing through the points (−1,−9) and (1, −5) is:

a. $y = 2x - 7$ b. $y = 7x + 2$

c. $y = -3x + 2$ d. $y = x + 1$

e. $y = 7x - 3$

2. The equation of the tangent line at $x = 3$, $y = -3$ to the curve $y = 3(2x - 7)^{1/3}$ is

a. $y = -12x + 25$ b. $y = 12x + 23$

c. $y = 2x - 9$ d. $y = -x + 6$

e. $y = -24x + 49$

3. Let $f(x) = x^4 + x^2 + 1$ and $g(x) = \frac{1}{\sqrt{x}}$. Then $g(f(x)) =$

a. $\frac{1}{\sqrt{x^4+x^2+1}}$ b. $x^2 + x + 1$

c. $\sqrt{x^4 + x^2 + 1}$ d. $\frac{1}{x^2} + \frac{1}{x} + 1$ e. $\frac{1}{\sqrt{x^2 + x + 1}}$

4. The point of inflection of $y = \frac{1}{2}x^3 + 3x^2 - 13$ occurs at x =

a. –2 b. –1 c. 0 d. 1 e. 2

5. Find the slope of the curve defined by the equation

$y^{1/2} + xy + -10 = 0$

at the point $x = 2,\ y = 4$ on the curve,

a. $-\frac{16}{9}$ b. $\frac{2}{3}$ c. $-\frac{2}{3}$ d. $\frac{16}{9}$ e. $\frac{3}{4}$

6. Let $f(x) = \sqrt[3]{x}$.

Use the first derivative of f(x) to find an approximate value of $\sqrt[3]{7.8}$.

a. $\frac{119}{60}$ b. $\frac{138}{71}$ c. $\frac{780}{396}$ d. $\frac{159}{80}$ e. $\frac{160}{81}$

7. The slope of the curve $y = x \ln x$ at $x = 1$ is:

a. $\frac{1}{3}$ b. 2 c. 0 d. 1 e. ln 2

8. $f(x) = x(3x^2 - 1)$: Find the largest value of $f(x)$ on the closed interval [0, 1]

a. 2 b. 3.8 c. 8 d. $\frac{1}{3}$ e. 0

9. A particle moves along the x axis in such a way that its instantaneous velocity $v = 4 \sin \pi t$ for $-\frac{1}{2} \leq t \leq \frac{1}{2}$.

Find the value of its acceleration when $v = 0$.

a. 4π b. -4π c. 9 d. 5 e. 0

10. $\sin 1050° =$

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

11. $\int_1^e \frac{(\ln x)^{\frac{3}{2}}}{x}\, dx =$

(a) $\frac{5}{2}$ b) 3 (c) $\frac{3}{2}$ (d) $\frac{2}{5}$ (e) $\frac{2}{3}$

12. A solid of revolution is obtained by rotating the part of the graph of $f(x) = \frac{1}{x}$ between $x = 1$ and $x = 10$ around the x-axis. Its volume is:

(a) $\frac{9\pi}{10}$ (b) 10π (c) $\pi \ln 10$ (d) $-\frac{\pi}{10}$ (e) $\frac{3\pi}{5}$

13. A circle of radius 2 is shown in the figure at the left. The area of the shaded region is given by one of the following:

$$x^2 + y^2 = 4$$

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

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

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

(d) $\int_0^4 \sqrt{4 - x^2}\, dx$

(e) $\pi\int_0^2 \sqrt{4 - x^2}\, dx + \pi\int_{-2}^{0} \sqrt{4 - x^2}\, dx$

14. On a small planet the acceleration due to gravity near the surface is 25 ft/sec^2. A person throws a rock upward with initial velocity 40 ft/sec. The time that it takes for the rock to reach its greatest height above the initial position is

(a) 1.6 sec (b) 2.4 sec (c) 3.1 sec
(d) 1.1 sec (e) 1.5 sec

15. In the definite integral $\int_0^1 e^x \sin(e^x)\,dx$ let $u = e^x$.

The resulting definite integral in u is

(a) $\int_1^e \sin u\,du$ (b) $\int_0^1 \sin u\,du$ (c) $\int_1^e \cos u\,du$

(d) $\int_0^1 e^u \sin u\,du$ (e) $\int_1^e e^u \sin u\,du$

16. Which of the following functions is a solution of the differential equation $y'' + 4y = 0$

(a) $y = e^{-t}$ (b) $y = \sin t$ (c) $y = \cos 2t$

(d) $y = -2t^2$ (e) $y = -3 + t^2$

17. Find the constant solutions (if any exist) of the differential equation $y' = t(y^2 - y - 6)$

(a) $y = 3$ and -2 (b) $y = 2$ only (c) $y = 2$, and -2 (d) $y = -2$ only (e) $y = 0$, and 2

18. Solve the initial value problem

$$y' = \frac{t+1}{y} \quad y(0) = 4$$

(a) $y = \sqrt{t^2 + 2t + 16}$ (b) $y = \frac{t^2}{2} + t + 4$ (c) $y = 4(t-1)^2$

(d) $y = \frac{1}{\sqrt{t^4 + t + 1}} + 4$ (e) $y = \ln(t+1) + 4$

A function f(t) satisfies a differential equation $y' = g(y)$. The graph of $z = g(y)$ is as sketched below. Use this graph for the next 2 problems

19. The graph of the solution f(t) has an inflection point somewhere on one of the following intervals. Which one?

(a) (–2,–1) (b) $\left(\frac{5}{6}, \frac{7}{6}\right)$ (c) (1,2)

(d) $\left(0, \frac{1}{5}\right)$ (e) $\left(-\frac{1}{3}, 0\right)$

20. For this differential equation locate the <u>stable</u> equilibrium states.

(a) $y = -1$ and $y = 1$ (b) $y = 1$ only (c) $y = 0$ and $y = 2$

(d) $y = 2$ only (e) $y = -1$ only

21. Which of the following sketches most closely resembles the solutions of the differential equation $y' = y(y + 2)$.

(a) (b) (c)

(d) (e)

The scores on a test taken by 20 people are given in the table below. Use this table for problems 22 and 23.

Score	60	70	80	90
frequency	2	8	7	3

22. The relative frequency of the score 80 is (correct to 2 decimal places).

(a) 0.35 (b) 7 (c) 0.25 (d) 1.22 (e) 0.73

23. The median score for all 20 test takers is

(a) 75 (b) 85 (c) 72 (d) 80 (e) 78

A random variable X has outcomes and probability distribution shown in the table below

k	$P(X = k)$
0	1/8
1	3/8
−1	1/8
3	3/8

24. The expected value of X is

(a) $\frac{11}{8}$ (b) $\frac{3}{8}$ (c) 2 (d) $\frac{13}{8}$ (e) $\frac{15}{8}$

25. A new random variable Y is given by $Y = X^2$ where X is the random variable of the preceding problem. The probability $P(X^2 = 1)$ is

(a) $\frac{4}{8}$ (b) $\frac{3}{8}$ (c) $\frac{5}{8}$ (d) $\frac{7}{8}$ (e) $\frac{2}{8}$

26. The odds in favor of your horse winning are 5 to 7. The probability that your horse will win is

(a) $\frac{5}{12}$ (b) $\frac{5}{7}$ (c) $\frac{2}{7}$ (d) $\frac{2}{5}$ (e) $\frac{12}{35}$

27. An apppliance costs $100 and the customer is considering purchasing insurance covering replacement in the event that the appliance breaks down within a year. If the rate of breakdowns is known to be 30% what is the most that the customer should pay for this insurance?

(a) $30 (b) $20 (c) $40 (d) $50 (e) $60

A test for a certain disease is 90% accurate in the sense that a positive result will occur 90% of the time if the patient does have the disease. The following tree diagram shows the relevant probabilities (D means patient has disease, H means patient does not have the disease.)

Compute the following probabilities

28. P(+ and D)

(a) .0090 (b) .01 (c) .90 (d) .99 (e) .10

29. $P(+) =$

(a) .108 (b) .009 (c) (0.90) (d) .90 (e) 1.0

30. $P(D \mid +) =$

(a) .08 (b) .05 (c) .90 (d) .20 (e) .10