1	2	3	4	5	6	7	8	9	10	11	12	13	14	**TOTAL**

DO NOT WRITE IN THE BLOCKS ABOVE

NAME_____ **MATH 1308**

INSTRUCTOR_____ **Spring 2023 Departmental Final Exam**

DIRECTIONS: You must show enough of your work so that the grader can follow what you did. If it is possible to find an exact answer by taking an algebraic approach, you may not receive full credit for an approximation or a calculator-generated answer.

1. Perform the indicated operations and simplify completely.

a) $(3x-1)(x+2)-(2x+5)^2$

b) $\frac{4a+12}{2a-10} \div \frac{a^2-9}{a^2-a-20}$

---

2. Solve the equation on the left; simplify the expression on the right.

a) $\frac{8}{3k-9} - \frac{5}{k-3} = 4$

b) $\frac{(5v^2)^3}{\sqrt{4v^6}}$

---

3. Bruiser bought two plots of land for a total of \$120,000. On the first plot, he made a profit of 15%. On the second, he lost 10%. His total profit was \$5,500. How much did he pay for each piece of land? (Note: Using a "guess-and-check" strategy to obtain a correct answer will not receive full credit.)

4. An RV that costs \$120,000 today is expected to depreciate linearly over an 8-year period, at which time it will be worth \$25,000 as scrap.
a) Find the rule of the depreciation function $f(x)$, where x stands for the number of years beyond today and $f(x)$ gives the value of the RV.

b) Interpret the meaning of the slope of the equation you found in part a).

c) If the RV were to continue depreciating beyond the 8-year period at the same rate, when would the RV be worth \$0?

---

5. Complete the following short answer questions.
a) Use appropriate log properties to write $5\ln(x) + 3\ln(4) - \ln(x^2)$ as a single log expression.

b) Express $\frac{5}{x^3}$ as an equivalent expression with a negative exponent.

c) Express the radical expression $\sqrt[3]{x^4}$ as an equivalent exponential expression.

d) Given a linear cost function $C(x) = 13x + 1700$, what is the marginal cost of producing the 101^{st} item?

6. If $f(x) = 2 - 3x^2$, find and simplify the difference quotient: $\frac{f(x+h) - f(x)}{h}$ $(h \neq 0)$.

---

7. The manager of a bicycle shop has found that, at a price (in dollars) of $p(x) = 150 - \frac{x}{4}$ per bicycle, x bicycles will be sold.

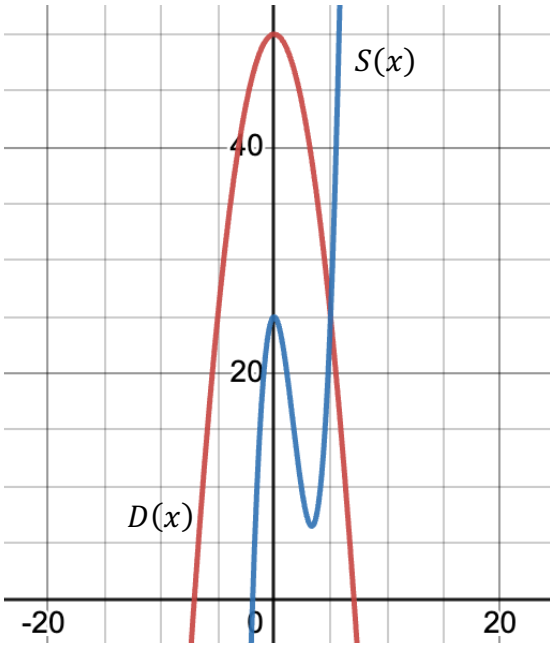
a) Find an expression for the total revenue from the sale of x bicycles. (Hint: Revenue = Demand × Price.)

b) Find the number of bicycle sales that leads to a maximum revenue.

c) Find the maximum revenue.

8. Consider the graph to the right, showing two polynomial functions.

a) Give the smallest possible value for the degree, n, of the function $S(x)$.



b) Is the leading coefficient of the function $D(x)$ positive or negative?

c) How many positive solutions does $S(x)$=0 have?

d) Assuming that $D(x)$ is a demand function and that $S(x)$ is a supply function, what is the equilibrium point for this market?

---

9. Suppose the total value for Bearcoin was \$100 billion in January 2020 and \$750 billion in January 2021.

a) Find an exponential function of the form $f(t) = y_0 \cdot b^t$ to model this data, with t representing the number of years since January 2020 and $f(t)$ in billions of dollars.

b) If the model remains accurate, what is the predicted value for June 2022?

10. The owner of a food truck selling tacos must pay a one-time fee of $2,500 to operate in the city of Waco. The owner finds that each taco costs $2 to make, while he can sell each taco for $4.50.

a) Find the cost, revenue and profit equations for the owner, assuming that each is linear.

b) What is the average cost of producing 100 tacos?

c) How many tacos must the owner sell to break even?

---

11. a) Find the compound amount for $1,000 at 7.5% compounded quarterly for 5 years. (Round to the nearest cent.)

b) Find the present value for the future amount $12,000 at 6% compounded continuously for 11 years. (Round to the nearest cent.)

---

12. A population is increasing according to the growth law $y = 2e^{0.02t}$, where y is in millions and t is in years.

a) What is the initial population?

b) How large will the population be in 4 months?

c) How long will it take for the population to triple?

13. A local minor league baseball team had 7000 fans in attendance for a particular game. Total ticket sales were $26,400. Box seats cost $6, grandstand seats cost $4, and bleacher seats cost $2. Suppose the number of tickets sold for bleacher seats was three times the number of box seats sold.
a) Set up a system of equations whose solution would give the number of tickets of each type that were sold. Clearly define your variables!

b) Using your calculator and an augmented matrix, find how many tickets of each type were sold. Write the augmented matrix that you plugged into your calculator, the resulting matrix after applying Gauss-Jordan, and how many tickets of each type below.

---

14. For this problem, let $A = \begin{bmatrix} 1 & 1 & 1 \\ 2 & 3 & 0 \\ 1 & 2 & 1 \end{bmatrix}$, $B = \begin{bmatrix} 1.5 & 0.5 & -1.5 \\ -1 & 0 & 1 \\ 0.5 & -0.5 & 0.5 \end{bmatrix}$, and $C = \begin{bmatrix} 2 \\ 5 \\ -1 \end{bmatrix}$.
a) Use your calculator to compute the product of matrix A and matrix B. Record your answer below and describe what your answer tells you about the relationship between matrix A and matrix B.

b) Use your calculator to compute the product of matrix B and matrix C. Record your answer below and describe what your answer tells you about the system $AX = C$, where $X = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$.