

EDT Mini-Test Solutions

Section 1. Arithmetic and Algebra

1. Express the following as a fraction: $\frac{1}{2} + \frac{2}{3} - \frac{3}{5} + \frac{5}{6}$

$$\begin{aligned} &= \frac{15}{30} + \frac{20}{30} - \frac{18}{30} + \frac{25}{30} \\ &= \frac{15 + 20 - 18 + 25}{30} \\ &= \frac{42}{30} \\ &= \frac{7}{5} \end{aligned}$$

Reason for the Question: The questions tests ones basic understanding of fraction properties.

What I think when I see the Question: When dealing with fractions, it is always good to have some commonality and to work with small numbers. Therefore I try to find a common denominator (smallest one I can think of) and reduce if possible.

The most likely/common denominator will of course be 30 as it is the lowest common multiple of all 4 numbers.

2. Evaluate: $\log_3 27 - \log_3 9$

Method 1

$$\begin{aligned} &= \log_3 \left(\frac{27}{9} \right) \\ &= \log_3 3 \\ &= 1 \end{aligned}$$

Method 2

$$\begin{aligned} &= \log_3(3^3) - \log_3(3^2) \\ &= 3 - 2 \\ &= 1 \end{aligned}$$

Reason for the Question: The questions tests ones basic understanding of logarithmic properties.

What I think when I see the Question: What is a log function, are there any properties that may be useful (addition/subtraction properties), is the base relevant, how do I evaluate it.

Student can either use the addition/subtraction rule of logs, or solve it directly by doing each sum separately.

$$\begin{aligned} 3. \text{ Solve: } & |5| - |-23| \\ & = 5 - 23 \\ & = -18 \end{aligned}$$

Reason for the Question: The question tests ones basic understanding of absolute values.

What I think when I see the Question: What does absolute value mean...magnitude? Now how do I go about solving such an equation?

The concept of absolute values, as it pertains to addition/subtraction. The student must recognize the extent to which the absolute value bars apply. They only apply to the -23 , and not the entire sum, even though both the 5 and the -23 are looked at in absolute terms.

4. Find the equation of the line that passes through (1, -6), and is parallel to the line $x + 2y = 6$. What is the slope of the new line, and if $x = 2$ what is y ?

In order to find a line that is parallel to $x + 2y = 6$, we first need to solve for its slope. This can be done by converting the equation into the standard $y = mx + b$ format.

$$\begin{aligned} x + 2y &= 6 \\ 2y &= -x + 6 \\ y &= \frac{-x}{2} + 3 \\ \therefore m &= \frac{-1}{2}, b = 3 \end{aligned}$$

Now that we have the slope of the “old line”, we know this is also the slope of the new line, as the two are parallel.

$$\begin{aligned}\frac{y - y_0}{x - x_0} &= m \\ \frac{y - (-6)}{x - 1} &= \frac{-1}{2} \\ \frac{y + 6}{x - 1} &= \frac{-1}{2} \\ y + 6 &= \frac{-1}{2}x + \frac{1}{2} \\ y &= \frac{-1}{2}x - \frac{11}{2} \\ \therefore x = 2, & \text{ then} \\ y &= \frac{-1}{2}(2) - \frac{11}{2} \\ y &= \frac{-13}{2} \text{ or } -6.5\end{aligned}$$

Reason for the Question: The question tests one's basic understanding of a linear equation, slope, methods to derive slope, and the meaning of being parallel.

What I think when I see the Question: What is a straight line and how is it represented mathematically. Given the equation, does it tell me any information (slope, intercepts etc.) that may be useful? What information do I need to solve the question, and what information am I given? (Points, slope etc.) The question looks at the mechanical and mathematical understanding of straight lines. Understanding slope, equations of lines, $y = mx + b$, solving the equations, are important tasks. It is crucial to focus on the thought pattern of the solution, as this is what is more important.

5. The expression $f(x) = 2x^2 + x + 1$ is
- Always negative
 - Always zero
 - Always positive
 - Sometimes positive, sometimes negative, depending on the value of x

Method 1: Complete the square.

$$f(x) = 2x^2 + x + 1$$

$$f(x) = (2x^2 + x) + 1$$

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

$$f(x) = 2\left(x^2 + \frac{1}{2}x + \frac{1}{16}\right) + 1 - \frac{1}{8}$$

$$f(x) = 2\left(x + \frac{1}{4}\right)^2 + \frac{7}{8}$$

Looking at the result of completing the square, we can see that the minimum of $f(x)$ is $7/8$, this being said, it is possible to conclude that the function is always positive.

Method 2: Check the multiple-choice answers and see if any can be eliminated. A) and B) can be ruled out quite easily. Note calculus could be used, numbers might be used, and there are more strategies that can be tried.

The answer is c).

Reason for the Question: The question tests ones ability to logically determine basic properties of an equation.

What I think when I see the Question: What type of equation is this, can I try to picture it in my head, if not can I factor it to solve for some critical values, can I complete the square, or should I just plug in some numbers and see what happens?

6. The formula $A(t) = A_0e^{rt}$ is used to compute the future value of an investment with interest compounded continuously. $A(t)$ is the future value at time t , A_0 is the initial investment, r is the annual interest rate, and t is time measured in years.
- Given that \$1000 is invested for three years at 6% interest, what is the value of the investment with continuous compounding of interest at maturity?
 - At an annual rate of 10%, how long will it take to double your investment, assuming continuously compounding of interest?

Given: $A_0 = 1000$, $t = 3$ years, $r = 6\%$

$$A(t) = A_0e^{rt}$$

a. $A(3) = 1000(e^{0.06 \times 3})$
 $A(3) = 1197.22$

- b. In order to double your investment, you will start out with A_0 and end up with $2A_0$.

$$\begin{aligned}A(t) &= A_0 e^{rt} \\2A(0) &= A(0)(e^{0.1 \times t}) \\2 &= e^{0.1t} \\\ln 2 &= \ln(e^{0.1t}) \\\ln 2 &= 0.1t \ln(e) \\t &= \frac{\ln 2}{0.1} = 6.93\end{aligned}$$

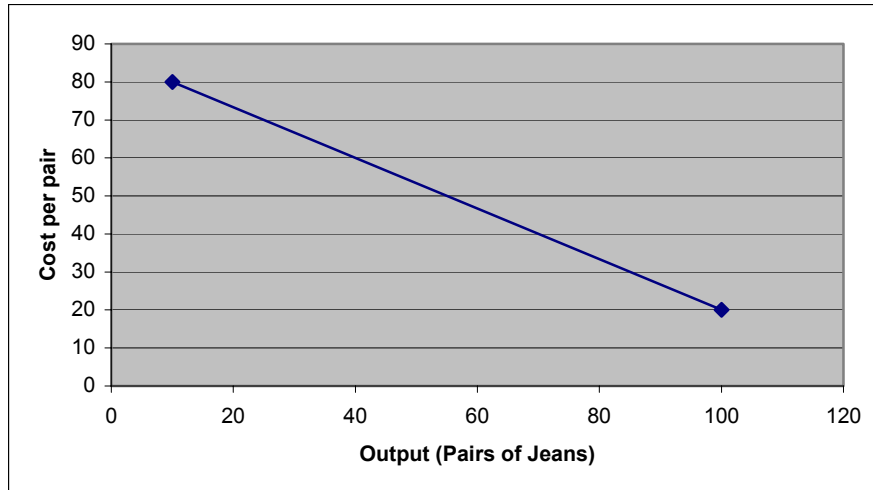
Hence it would take just under 7 years.

Reason for the Question: The question tests one's ability to take new material and apply it in the given situation, and using basic math properties to derive a conclusion.

What I think when I see the Question: This is a question that presents new material, and relies on understanding what is being given to you. For example, the doubling of one's investment does imply \$1000 turns into \$2000, or A turns into 2A.

Section 2: Graphing:

7. After doing some production research, you determine that to produce 10 pairs of jeans it will cost you on average, \$80/unit. You determine that as prices decrease to \$20/unit, your firm is willing to produce 100 pairs of jeans. Assume the firm's supply curve is a linear function joining these two points.
 - a. Plot these two points on the graph provided.
 - b. Join the two points with a straight line.
 - c. What is the equation of the line?
 - d. If the market is willing to pay \$50/unit, how many pairs of jeans should your firm produce?



$$\frac{y - y_0}{x - x_0} = m$$

$$\frac{80 - 20}{10 - 100} = m$$

$$\frac{60}{-90} = m = \frac{-2}{3}$$

$$\therefore \frac{y - y_0}{x - x_0} = \frac{-2}{3}$$

$$\frac{y - 80}{x - 10} = \frac{-2}{3}$$

$$y - 80 = \frac{-2}{3}x + \frac{20}{3}$$

$$y = \frac{-2}{3}x + \frac{260}{3}$$

$$\ominus y = 50$$

$$50 = \frac{-2}{3}x + \frac{260}{3}$$

$$\frac{-110}{3} = \frac{-2}{3}x$$

$$x = 55$$

Reason for the Question: The question tests ones basic understanding of graph theory.

What I think when I see the Question: Graph theory, what is needed to graph a straight line, points are good.

8. A restaurant must choose its main dinner entrée for each night of the week, beginning on Sunday and ending on Saturday. The possible entrées are Chicken, Beef, Veal, Pork, Pasta, Fish, and a Vegetarian dish, each of which will be used on a different night. The following conditions must be met when determining the menu:

The Chicken must be served either the night before or the night after the Pasta is served.

The Beef must be served either the night before or the night after either the Pork or the Fish is served.

The Vegetarian dish cannot be served the night before or the night after the Veal is served.

The Veal must be served on Monday.

NOTE: Some of the following questions have multiple answers; you are not required to show all the possible answers, and merely how you derived yours.

- a. When can the Vegetarian dish be served?
- b. What is a possible menu order from Sunday to Saturday
- c. If Chicken is served on Saturday, can Pasta be served on Thursday? Can Pork be served on Wednesday? Explain
- d. If Fish is served on Thursday, the Pork must be served on which day?

- a. Thursday or Saturday
- b. Fish – Veal – Beef – Pork – Veggie Dish – Chicken – Pasta
- c. NO it can't, Veggie is on Thursday, and Yes Pork can be served on Wed.
- d. Sunday

Reason for the Question: The question tests ones ability to problem-solve.

What I think when I see the Question: Can I draw out the information and make it easier on myself, are there any clues hidden in the question that may add to my initial conditions?