Assessment Evaluation - POST Math Prefresher - 9/2021 ANSWER KEY
We've just spent a magical week together. This is to see how much stuck from the course and to help you identify areas that could use more attention and development. Do your best. **Note: THERE ARE TWO SIDES!**

Background questions:
Name, discipline and subfield?

Questions

1. Basics
   (a) Explain the significance or use of the following symbols:
      i. Σ ANS: This is for the summation of a series
   (b) Solve: (no need to simplify but show steps/work if possible)
      i. $5 \geq x - 3$ ANS: $x \leq 8$
      ii. $-9x + 2 > 3$ ANS: $x < \frac{-1}{9}$
      iii. $|x - 2| \leq 3$ ANS: $-1 \leq x \leq 5$
      iv. $2e^{6x} = 18$ ANS: $e^{6x} = 9$, $x = \frac{ln(9)}{6}$ or $ln(9^{1/6}$
      v. $e^{x^4} = 1$ ANS: $x^4 = 0$ so $x = 0$
      vi. $ln(x^2) = 5$ ANS: $ln(x) = 2.5$, so $x = e^{2.5}$
      vii. $\sum_{n=1}^{10} 2 + 5n$ ANS: $2 * 10 + 5 * (10 * (11))/2 = 20 + 5 * 55 = 295$
      viii. 5!ANS: $5 * 4 * 3 * 2 * 1$
      ix. $(\frac{x^6 y^{-3}}{x^2 y^3})^3$ ANS: $(\frac{x^4}{y^6})3 = \frac{x^{12}}{y^{18}}$
   (c) Factor
      i. $m^2 + 3m - 4$ ANS: $(m - 1)(m + 4)$
      ii. $x^2 + 6x + 9$ ANS: $(x + 3)^2$
      iii. $2x^4 - 4x^2$ ANS: $2x^2(x^2 - 2)$

2. Set Theory

(a) Explain the meaning of the following symbols:

i. $\in$ ANS: 'an element of'

ii. $\forall$ ANS: 'for all'

(b) Suppose $A = \{3, 6, 12\}$, $B = \{$hat, bulldozer, forklift$\}$ and $C = \{x | x$ is a natural number$| x > 3$ and $x < 9\}$

i. What is $A \cup B$? ANS: $\{3, 6, 12,$ hat, bulldozer, forklift$\}$

ii. Write the elements of C ANS: $\{4, 5, 6, 7, 8\}$

iii. What is $A \cap C$? ANS: $\{6\}$

iv. What is $A \setminus C$? ANS: $\{3, 12\}$

3. Functions & Pre-Calculus

(a) What is a continuous function? ANS: One you can draw without picking up a pencil – where the limit from the left equals that from the right and equals the value at the point (and the value exists!)

(b) Draw an increasing function. ANS: one where y gets larger as x increases (x and y move together–positive slope)

(c) What is a tangent line? What does it do? ANS: The tangent line is one that touches the graph of a function at only one point.

(d) What is a derivative? ANS: an instantaneous rate of change – the slope of the tangent line at a particular point

4. Matrix Algebra

(a) Give an example of a 3×4 matrix $\begin{bmatrix} a & d & g & j \\ b & e & h & k \\ c & f & i & l \end{bmatrix}$

(b) Consider the following matrices:

$\mathbf{A} = \begin{bmatrix} 3 & 4 & 1 \\ 0 & 2 & 1 \end{bmatrix}$ $\mathbf{B} = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 2 & 4 \end{bmatrix}$ $\mathbf{C} = \begin{bmatrix} 1 & 4 & 1 \\ 0 & 2 & 1 \\ 6 & 2 & 9 \end{bmatrix}$

i. Which matrices can be added together? A and B can be added together because they have the same dimensions 2×3

ii. Add the matrices from the above response. $\begin{bmatrix} 3 & 5 & 2 \\ 1 & 4 & 5 \end{bmatrix}$

iii. Which matrices can be multiplied together? ANS: A and B can each be multiplied by C (SO, $A * C$) but cannot multiply A and B by each other or C by A or B (so, yes AC, no CA) We know that because A is 2x3 and C is 3x3, we can multiply them (middle two numbers same). We also know that the dimensions of the final matrix will be the number of rows in A (2) and the number of columns in C (3) – so 2x3.

iv. Multiply the matrices from the above response. Can do $A * C$ or $B * C$. $A * C$ as example: $\begin{bmatrix} (3*1+0+1*6) & (3*4+4*2+1*2) & (3*1+4*1+1*9) \\ (0+0+6*1) & (0+2*2+1*2) & (0+2*1+1*9) \end{bmatrix}$

5. Calculus

(a) what is the derivative of 4? ANS: 0

(b) what is the derivative of $2x$? ANS: 2

(c) calculate the derivative of $7m^2 - m + 2$ ANS: $14m - 1$

(d) calculate the integral $\int_0^5 (x^3 + 0.5x^2 + 5x)dx$ ANS: $x^4/4 + x^3/6 + 5/2x^2|_0^5$

(e) calculate the integral $\int e^x dx$ ANS: $e^x + c$