Pre-Assessment Evaluation

Andrew Saab

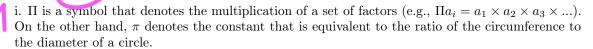
Background Questions

My name is Andrew Saab, a political science Ph.D. student. I am hovering between American and Comparative politics, but will pursue methods as a subfield with certainty. I hope to refresh some basic mathematical concepts and intuition that tend to be notoriously forgotten even among those with more advanced backgrounds.

12+13.5 £ 25.5) Problem Solving Questions







ii. Σ denotes a summation of a set of factors (e.g., (e.g., $\Sigma a_i = a_1 + a_2 + a_3 + ...$).

(b)

i.
$$4 \ge x - 7 \implies 4 + 7 \ge x - 7 + 7 \implies x \le 11$$

ii.
$$-9x + 2 > 3 \implies -9x + 2 - 2 > 3 - 2 \implies -9x > 1 \implies -x > \frac{1}{9} \implies x < -\frac{1}{9}$$
iii. $|x - 2| \le 2 \implies x - 2 \le 2$ and $x - 2 \ge -2$

$$x \le 4 \text{ and } x \ge 0$$

iii.
$$|x-2| < 2 \implies x-2 < 2 \text{ and } x-2 > -2$$

$$x \le 4$$
 and $x \ge 0$

iv.
$$2e^{6x}=18 \implies e^{6x}=9 \implies lne^{6x}=9 \implies 6xlne=9 \implies x=\frac{9}{6}=\frac{3}{2}$$
 (Note: $lne=1$)

$$e^{x^2} = 1 \implies lne^{x^2} = 1 \implies x^2 lne = 1 \implies x^2 = 1 \implies x = 1 \text{ or } x = -1$$

vii.
$$\sum_{n=1}^{10} 3 + n = \sum_{n=1}^{10} 3 + \sum_{n=1}^{10} n = (10 \times 3) + (1 + 2 + \dots + 10) = 30 + 55 = 85$$

viii.
$$4! = 4 \times 3 \times 2 \times 1 = 24$$

jx.
$$\left(\frac{x^4y^{-3}}{x^2y^3}\right)^3 = \frac{x^{12}y^{-9}}{x^6y^9} = x^6y^0 = x^6$$

(c)

i.
$$m^2 + 3m + 2 = (m+1)(m+2)$$

$$x^2 + 5x + 6 = (x+2)(x+3)$$

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

2. Set Thony

i. \in denotes that a partcular element belongs to a set.

ii. \forall is used to express that a particular statement holds for all values satisfying the specified conditions (e.g., $\frac{x}{y} = 1 \ \forall x = y$).

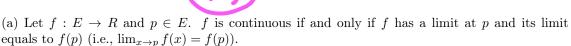
(b)

i. $A \cup B = \{3, 4, 5, hat, triangle, forklift\}$

ii.
$$C = \{4, 5, 6, 7, 8\}$$

iii.
$$A \cap C = \{4, 5\}$$

3. Functions and Pre-Calculus



Additionally, this is true if and only if $\forall \varepsilon > 0$, $\exists \delta$ s.t. if $x \in E$ and $|x-p| < \delta$ then $|f(x)-f(p)| < \varepsilon$. This means that one can always find a point x within the domain such that the distance between f(x) and f(p) can be chosen to be arbitrarily small.

- (b) Unfortunately, I do not have the skills to draw on LaTeX. However, the definition of an increasing function is one such that $f(x+\varepsilon) \geq f(x) \ \forall x \in R$ and $\forall \varepsilon > 0$. A function is strictly increasing if $f(x+\varepsilon) > f(x)$ (i.e., f(x) = x).
- (c) A tangent line is one that just touches a curve at a particular point. The slope of this tangent line indicates the curve's instantaneous rate of change at the point of contact with the curve. The slope of a tangent line can be calculated by taking the first derivative of a function and plugging the values of the domain to calculate the rate of change at the desired point.
- 4. Matrix Algebra
- (a) I have taken a course on linear algebra at the undergraduate and graduate level. I have used its applications extensively in econometrics courses.

(b)
$$\begin{pmatrix} 1 & 2 & 3 & 4 \\ 5 & 6 & 7 & 8 \\ 9 & 10 & 11 & 12 \\ 13 & 14 & 15 & 16 \end{pmatrix}$$

5. Calculus

(a)
$$\frac{d(4x)}{dx} = 4$$

(b)
$$\frac{d(3m^2-8m+5)}{dm} = 6m - 8$$

(c)
$$\int_0^5 (x^3 + 0.5x^2 + 5x) dx = \frac{1}{4}x^4 + \frac{0.5}{3}x^3 + \frac{5}{2}x^2 + c \Big|_0^5$$

Plug in 5 and subtract result from that obtained when plugging in 0.

(d)
$$\int e^x dx = e^x + c$$