

B.A. 1st year 1st semester
2019 (Old)
Mathematics for Economics

Time: 2 hours

Full marks: 30

Answer question number 1 and any two from the rest:

1.

- a. Let $f(x) = x^5 + 2$. Identify the critical point of the function. Check whether, the function has a relative maximum, a relative minimum or neither.
- b. Consider the following argument: The Washington Redskins are better than the Miami Dolphins. But the Miami Dolphins are better than the Buffalo Bills. Therefore, The Washington Redskins are better than the Buffalo Bills.
Check the validity of the argument using the appropriate logic law .
- c. Identify the asymptotes and / or holes in the following function :
$$\frac{1 - 6x}{3x + 7}$$
- d. Check the curvature of the following functions :
 - i. $f(x) = x^3 + 2x$ at $x = -1$ & $x = 2$
 - ii. $f(x) = e^x$ at $x = -2$ & $x = 2$
- e. Define an asymmetric relation .Show that $R = \{ (a, b) : a > b \}$ is an asymmetric relation. 5X2

2. i. Determine whether the following statements are true or false :

- a. $\forall x \exists y (x < y)$; *Universe is R*
- b. $\exists y \forall x (x < y)$; *Universe is R*
- c. $P \vee (Q \wedge \neg P) \Leftrightarrow P \vee Q$
- d. $(P \vee \neg Q) \wedge (\neg P \vee \neg Q) \Leftrightarrow \neg Q$

ii. Prove that under appropriate assumptions if f' is increasing on (a, b) then f is convex on $[a, b]$. In particular f is convex if f'' exists and is non-negative in (a, b) . 6+4

3. i. Check whether the following functions are bijective functions

- a. $f: Z \rightarrow Z$, where $f(z) = 2 * z$
- b. $f: \{(x, y) \in R^2 : y = x^2\}$

ii. Sketch the graph of the function:

$$\frac{1}{3}x^3 + 2x^2 + x + 5$$

3+7

4. i. Prove the following using inference rules :

$$P1: (X \vee Y) \rightarrow Z$$

$$P2: (Z \vee T) \rightarrow W$$

$$P3: X$$

$$\text{Conclusion: } W$$

ii. State and prove mean value theorem for derivatives. Explain what this theorem implies. State one theorem where mean value theorem is used in proof.

$$3+7(=3+2+2)$$