**Part I (Encircle the Correct Answer in the following Questions)** **[3 points each]**

**1.** The smallest positive angle **coterminal** with the angle $q = -725^\circ$ is

$a)\ 175^\circ$ $b)\ 85^\circ$ $c)\ 355^\circ$ $d)\ 185^\circ$

**2.** All **possible zeros** of the polynomial $p(x) = 2x^5 - 2x^4 + 7x^3 - 8x^2 + 4x - 16$ are

$a) \pm 1, \pm\frac{1}{2}, \pm 2, \pm 4, \pm 8, \pm 16$ $(b) \pm 1, \pm 2, \pm 4, \pm 8, \pm 16$

$c) \pm 1, \pm\frac{1}{2}, \pm\frac{1}{4}, \pm\frac{1}{8}, \pm\frac{1}{16}$ $(d) \pm 1, \pm 2, \pm\frac{1}{2}, \pm\frac{1}{4}, \pm\frac{1}{8}, \pm\frac{1}{16}$

**3.** The **horizontal asymptote(s)** of $f(x) = \frac{3(x-4)(2x+3)}{x^2-9}$ is (are) given by

$a)\ y = 8$ $b)\ y = 3$ $c)\ y \pm 0$ $d)\ y = 6$

**4.** If $f(x) = e^x - e^{-x}$, then $f(2\ln 3)$ is

$a)\ y = 0$ $b)\ y = \frac{80}{9}$ $c)\ y = \frac{40}{3}$ $d)\ y = 1$

**5.** The smallest positive integer detected by the "Bounds Theorem" as an **upper bound** for the real zeros of $p(x) = 2x^3 + 4x^2 - 8x + 3$ is

$a)\ 2$ $b)\ 4$ $c)\ 3$ $d)\ 1$

**Part II (Solve the following questions showing all necessary steps)**

**1a) Use the Descartes' Rule of Signs** to discuss the **nature of the zeros** of $p(x) = 4x^4 - 7x^3 + 3x + 2$. Write all the possibilities in a **table**. (5 pts)

**1b)** Given that $3i$ is a zero of **multiplicity** 2 of $p(x) = x^5 - x^4 + 18x^3 - 18x^2 + 81x - 81$. Find the **other zeros**. (7 pts)

**2)** Find the **solution** of the equation $\frac{1}{2}x^3 + \frac{1}{6}x^2 - \frac{4}{3}x + \frac{2}{3} = 0$. (8 pts)

**3)** Find a polynomial $p(x)$ of **degree** 6 such that –3, 1 and 2 are its only **zeros**, its graph is **above** the $x$- axis between 1 and $\infty$, below the $x$- axis between $-\infty$ and 1, and $p(0) = -9$. [*Hint*: Draw a rough graph of $p(x)$] (8 pts)

**4)** Consider the rational function $f(x)=\dfrac{x^3-4x}{x^2-3x+2}$.

**4a)** Find all **asymptotes**, if any, of $f(x)$. (3 pts)

**4b)** Find the ***x*-intercept(s)**, ***y*-intercept** and the **hole(s)**, if any, of $f(x)$. (3 pts)

**4c)** Sketch the **graph** of $f(x)$. [Note: You must use all the information obtained in (4a) and (4b)]. (4 pts)

**5)** Find the **solution** of the equation $(125)^{3-x}=(25)^{x}5^{1-x}$. (6 pts)

**6a)** The population of a city at present is 64,000. After $t$ years from now, the population will be given by the **function** $P(t)=64000e^{t/5}$. **After how much time** will the population of the city reach 128000? (5 pts)

**6b)** Write the following as a **single logarithm** and **simplify** your answer: (5 pts)

$$3\log_2(y^2z)-2\log_2(xy^2)+\log_2(x^3yz^4).$$

**7)** Let $f(x)=\log_{\frac{1}{2}}(3-x)$.

**7a)** Applying **translations and reflections** to the **graph** of the function $\log_{\frac{1}{2}}x$, **sketch the graph** of $f(x)$. (4 pts)

**7b)** Find the **domain**, the **range** and the **asymptote(s)**, if any, of the **function** $f(x)$. (3 pts)
[You may use the graph of $f(x)$ to give your answer directly.]

**7c)** Find the **inverse function** $f^{-1}(x)$**.** (4 pts)

**8)** Find the **solution set** of the equation $\dfrac{1}{3}\log_2(x+5)+\log_8(3x-1)=2$. (6 pts)

**9)** A wheel of a truck has a radius 1.6 feet.

**9a) How far** will the truck move if the wheel **turns through** $40^\circ$ ? (4 pts)

**9b)** If the wheel is **rotating** at the rate of 6 **revolutions** per second, **find the speed** of the truck in feet per second. (5pts)