Qatar University
Foundation Program
Math and Computer Department

Mathematics for Sciences and Engineering - Math 3 (814013)
Midterm Exam - Spring 2007

Student Name: _____ Student No.: _____

Instructor Name: _____ Group No.: _____

Exam Regulations:

1. The time limit is **90 minutes.**
2. Calculators and Graphing Calculators are **not** allowed.
3. Partial credit may be awarded. You must **show all work** in order to qualify for full credit.
4. Don't leave questions answered in pencil in order to have the right of regrading them in case of any grading complaints.
5. Mobiles should be turned off during the exam time.
6. Your examination contains **6 pages** in addition to the cover page. Please page check your exam.

Question	Possible	Score
1	10	
2	3	
3	22	
4	15	
5	11	
6	10	
7	11	
8	3	
9	10	
10	5	
Total	100	

Q1. (**10 points**)

Note: Throughout the Question, the following notations are used:

I: is the set of irrational numbers

R: is the set of real numbers.

Z: is the set of integers.

Answer each question with **TRUE (T)** or **FALSE (F)**

Let $A = \{3n \,|\, n \in Z\}, B = \{0, 3, 6\}$ and $C = \{-2, 2\}$.

(1) $\{-3\} \in A$ **(.....)**

(2) $0 \in C$ **(.....)**

(3) $B \subset A$ **(.....)**

(4) $C = \{x \in R \,|\, x^2 = 4\}$ **(.....)**

(5) $\{\emptyset\} \subset A$ **(.....)**

(6) $\sqrt{\pi^2} \in I$ **(.....)**

(7) The product of two irrational numbers is always irrational. **(.....)**

(8) If x and y are two integers then $\left(\frac{x}{y}\right)$ is a rational number. **(.....)**

(9) $\sqrt{4} - \sqrt{3}$ is a rational number. **(.....)**

(10) 0 is both rational and irrational number. **(.....)**

Q2. (**3 points**) Consider the polynomial: $30x^2 - x^3 + 7 + 5x^3 - 2x^4$.

(a) The degree of the polynomial is **.....**

(b) The coefficient of x is **.....**

Q3. (**22 points**) Factor **completely** relative to integers.

(a) (**5 points**) $5y(x+1)^2 - 20y^3$

(b) (**5 points**) $2t^3 + t^2 + 2t + 1$

(c) (**5 points**) $3m^4n + 24mn^4$

(d) (**7 points**) $2(p^2-2)^2 - 5(p^2-2) + 3$

Q4. (**8 points, 7 points**) Perform the indicated operations and reduce your answer to its **lowest terms**.

(a) $\dfrac{x^2-7x+10}{x^2-25} \div \dfrac{6x^2-12x}{3x+15}$

(b) $\dfrac{2x+4}{x^2-16} - \dfrac{x}{x+4} - \dfrac{2}{2x-8}$

Q5. (**11 points**) Express as a **simple fraction reduced to lowest terms**.

(a) (**6 points**) $\dfrac{1+\dfrac{2}{x}-\dfrac{15}{x^2}}{1+\dfrac{4}{x}-\dfrac{5}{x^2}}=$

(b) (**5 points**) $\dfrac{\dfrac{1}{(x+h)}-\dfrac{1}{x}}{h}=$

Q6. (**10 points 5 points each**) Simplify and write the answer using **positive exponents**.

(a) $\left(\dfrac{2a^{\frac{2}{3}}}{b^{\frac{1}{2}}}\right)^2\left(\dfrac{3^0a^{-\frac{1}{6}}}{b^{\frac{1}{3}}}\right)^6=$

(b) $\left(\dfrac{x^2y^{-1}}{3x^{-1}}\right)^{-2}\left(\dfrac{x^{-4}y^5}{x^3}\right)=$

Q7. (**5 points, 6 points**) Express in **simplified form**.

(a) $x\sqrt[3]{8xy} + \sqrt[3]{125x^4y} - 2\left(\frac{x}{y}\right)\sqrt[3]{27xy^4} =$

(b) $\sqrt[4]{27a^3b^3}\ \sqrt[4]{3a^5b^3}\ \sqrt{16a^3b^6} =$

Q8. (3 points)

Show that $1 + \dfrac{1}{1 + \dfrac{1}{1 + \dfrac{1}{2}}}$ is equal to $\dfrac{8}{5}$

Q9. (10 points, 5 points each) Perform the following operations and **simplify as much as possible**.

(i) $3x(x-2)^2 - 3(x-1)^3 - 3 =$

(ii) $5 - 2[x - (x-1)^2] + 2[1 - (3 - x(x-1))] - 4x^2 =$

Q10. (3 points, 2 points) There is a mistake in each of the following problems. Present the correct solution.

(a)
$$x + \frac{x-2}{x-1} = \frac{x+x-2}{x-1}$$
$$= \frac{2x-2}{x-1} = \frac{2(x \not{-1})}{(x \not{-1})} = 2$$

(b)
$$\frac{x^2+6x+\not{5}}{x+\not{5}} = \frac{\not{x}(x+6)}{\not{x}} = x+6$$