King Fahd University of Petroleum and Minerals

Prep-Year Math Program

Math 001 Class Test I
Textbook Sections: R.1 to R.7
Term 152
Time Allowed: 90 Minutes

Time: 6:00 pm – 7:30 pm

Student's Name: …………… ………………………………………………
ID #:………………………. **Section:** ……. **Serial Number:** …….

Provide neat and complete solutions.
Show all necessary steps for full credit and write the answer in simplest form.

No Calculators, Cameras, or Mobiles are allowed during this exam.

Question	**Points**	Student's Score
1	4	
2	4	
3	4	
4	4	
5	4	
6	4	
7	4	
8	4	
9	4	
10	4	
11	5	
12	5	
Total	**50**	___ / 50
		___ / 100

Q1. **(4 points):** Performing the correct order of operations:

$$\left[-2+\frac{11}{5}+\left(-\frac{11}{5}\right)\right]\div\left(\frac{1}{3}-\frac{1}{4}\right)-\left(\frac{-3^2}{4}\right)+2=$$

Solution:

$$\left[-2+\frac{11}{5}+\left(-\frac{11}{5}\right)\right]\div\left(\frac{1}{3}-\frac{1}{4}\right)-\left(\frac{-3^2}{4}\right)+2=(-2)\div\left(\frac{1}{12}\right)+\frac{9}{4}+2$$

$$=\frac{-2}{\frac{1}{12}}+\frac{9+8}{4}$$

$$=-\frac{24}{1}+\frac{17}{4}$$

$$=\frac{-96+17}{4}$$

$$=-\frac{79}{4}$$

Answer: (a) $-\frac{79}{4}$

Q2. **(4 points):** If the coefficient of x^3 in the product $x^2\left(kx-\frac{2}{k}\right)\left(5x+\frac{1}{k}\right)$ is 7, then $k=?$

Solution: $x^2\left(kx-\frac{2}{k}\right)\left(5x+\frac{1}{k}\right)=\left(kx^3-\frac{2}{k}x^2\right)\left(5x+\frac{1}{k}\right)$

Multiplying terms that give x^3:

$$kx^3\left(\frac{1}{k}\right)+\left(-\frac{2}{k}x^2\right)(5x)=7x^3$$

$$x^3-\frac{10}{k}x^3=7x^3$$

$$\left(1-\frac{10}{k}\right)x^3=7x^3$$

$$1-\frac{10}{k}=7$$

$$-\frac{10}{k}=6$$

$$\boxed{k=-\frac{5}{3}}$$

Answer: $\boxed{k=-\frac{5}{3}}$

Q3. (4 points) (R.1 Additional Exercise 19):

Simplify the expression $54x^2y-27y^3-(2x-3y)^3=$

Solution:

$$\begin{aligned}54x^2y-27y^3-(2x-3y)^3&=54x^2y-27y^3-\left[(2x)^3-3(2x)^2(3y)+3(2x)(3y)^2-(3y)^3\right]\\&=54x^2y-27y^3-8x^3+36x^2y-54xy^2+27y^3\\&=54x^2y-8x^3+36x^2y-54xy^2\\&=90x^2y-8x^3-54xy^2\end{aligned}$$

Q4. (4 points) (R.3 Additional Exercise 22): Divide $2x^4-3x^2-3x+1$ by x^2+x-1.

(a): Write your answer as $\dfrac{Dividend}{Divisor}=Quotient+\dfrac{Remainder}{Divisor}$

(b): Find the Quotient $Q(x)$ and the Remainder $R(x)$.

Solution:

$$\begin{array}{r|llll}
 & 2x^2 & -2x & +1 & \\
\hline
x^2+x-1 & 2x^4 & -3x^2 & -3x & +1\\
 & 2x^4 & +2x^3 & -2x^2 & \\
 & - & - & + & \\
\hline
 & -2x^3 & -x^2 & -3x & +1\\
 & -2x^3 & -2x^2 & +2x & \\
 & + & + & - & \\
\hline
 & & x^2 & -5x & +1\\
 & & x^2 & +x & -1\\
 & & - & - & +\\
\hline
 & & & -6x & +2
\end{array}$$

(a): $\dfrac{2x^4-3x^2-3x+1}{x^2+x-1}=2x^2-2x+1+\dfrac{-6x+2}{x^2+x-1}$

(b): $Q(x)=2x^2-2x+1$ $\qquad R(x)=-6x+2$

Q5. (4 points): (R.4 Textbook Exercise 96): Factor $q^2+6q+9-p^2$

Solution:

96. $$\begin{aligned}q^2+6q+9-p^2&=(q^2+6q+9)-p^2\\&=\left[q^2+2(q)(3)+3^2\right]-p^2\\&=(q+3)^2-p^2\\&=[(q+3)+p][(q+3)-p]\\&=(q+3+p)(q+3-p)\end{aligned}$$

Q6. (4 points): (5 points) (R.4 Textbook Exercise 32): Factor completely $36x^3 + 18x^2 - 4x$

Solution:

32. Factor out the greatest common factor, $2x$:
$36x^3 + 18x^2 - 4x = 2x(18x^2 + 9x - 2)$. Now
factor the trinomial by trial and error:
$18x^2 + 9x - 2 = (6x-1)(3x+2)$. Thus,
$36x^3 + 18x^2 - 4x = 2x(6x-1)(3x+2)$.

Q7. (4 points): (R.4 Textbook Exercise 65): Factor $27y^9 + 125z^6$

Solution:

65. $27y^9 + 125z^6$

$$= (3y^3)^3 + (5z^2)^3$$
$$= (3y^3 + 5z^2)\left[(3y^3)^2 - (3y^3)(5z^2) + (5z^2)^2\right]$$
$$= (3y^3 + 5z^2)(9y^6 - 15y^3z^2 + 25z^4)$$

Q8. (4 points): (R.6 Textbook Exercise 70): If a and b are positive real numbers, the simplify the expression $\left(\frac{25^4a^3}{b^2}\right)^{1/8}\left(\frac{4^2b^{-5}}{a^2}\right)^{1/4}$

Solution:

70. $\left(\frac{25^4a^3}{b^2}\right)^{1/8}\left(\frac{4^2b^{-5}}{a^2}\right)^{1/4}$

$$= \frac{25^{1/2}a^{3/8}}{b^{1/4}} \cdot \frac{4^{1/2}b^{-5/4}}{a^{1/2}}$$
$$= \frac{5a^{3/8}}{b^{1/4}} \cdot \frac{2b^{-5/4}}{a^{1/2}} = (5 \cdot 2)\frac{a^{3/8}}{a^{1/2}} \cdot \frac{b^{-5/4}}{b^{1/4}}$$
$$= 10a^{(3/8)-(1/2)}b^{(-5/4)-(1/4)}$$
$$= 10a^{(3/8)-(4/8)}b^{-6/4} = 10a^{-1/8}b^{-3/2}$$
$$= \frac{10}{a^{1/8}b^{3/2}}$$

Q9. (4 points): Simplify the expression and write the answer without absolute value symbols: $\sqrt{(-7)^2} + \sqrt{49 + 42x + 9x^2} + \sqrt[3]{(-7)^3}$ where $x < -3$

Solution:

$$\sqrt{(-7)^2} + \sqrt{49 + 42x + 9x^2} + \sqrt[3]{(-7)^3} = \sqrt{(-7)^2} + \sqrt{(7+3x)^2} + \sqrt[3]{(-7)^3}$$
$$= |-7| + |7 + 3x| - 7$$
$$= 7 + \left[-(7+3x)\right] - 7$$
$$= -7 - 3x$$

Q10. (4 points): (R.7 Textbook Review Exercise 101): Simplify $\dfrac{r^{-1}+q^{-1}}{r^{-1}-q^{-1}}\cdot\dfrac{r-q}{r+q}$

Solution:

101.
$$\frac{r^{-1}+q^{-1}}{r^{-1}-q^{-1}}\cdot\frac{r-q}{r+q}=\frac{\frac{1}{r}+\frac{1}{q}}{\frac{1}{r}-\frac{1}{q}}\cdot\frac{r-q}{r+q}$$
$$=\frac{rq\left(\frac{1}{r}+\frac{1}{q}\right)}{rq\left(\frac{1}{r}-\frac{1}{q}\right)}\cdot\frac{r-q}{r+q}$$
$$=\frac{q+r}{q-r}\cdot\frac{r-q}{r+q}=\frac{r-q}{q-r}$$
$$=\frac{r-q}{-1(r-q)}=-1$$

Q11. (5 points): Simplify the expression $5x\sqrt[3]{24x^4}+\dfrac{21x^3}{\sqrt[3]{-9x^2}}$

Solution:

$$5x\sqrt[3]{24x^4}+\frac{21x^3}{\sqrt[3]{-9x^2}}=5x\sqrt[3]{2^3(3)x^3x}+\frac{21x^3}{-\sqrt[3]{9x^2}}\cdot\frac{\sqrt[3]{3x}}{\sqrt[3]{3x}}$$
$$=5x(2)(x)\sqrt[3]{3x}-\frac{21x^3\sqrt[3]{3x}}{3x}$$
$$=10x^2\sqrt[3]{3x}-7x^2\sqrt[3]{3x}$$
$$=3x^2\sqrt[3]{3x}$$

Q12. (5 points): (R.5 Textbook Exercise 58): $\dfrac{5}{x+2}+\dfrac{2}{x^2-2x+4}-\dfrac{60}{x^3+8}=?$

Solution:

58.
$$\frac{5}{x+2}+\frac{2}{x^2-2x+4}-\frac{60}{x^3+8}=\frac{5}{x+2}+\frac{2}{x^2-2x+4}-\frac{60}{(x+2)(x^2-2x+4)}$$
$$=\frac{5(x^2-2x+4)}{(x+2)(x^2-2x+4)}+\frac{2(x+2)}{(x+2)(x^2-2x+4)}-\frac{60}{(x+2)(x^2-2x+4)}$$
$$=\frac{5(x^2-2x+4)+2(x+2)-60}{(x+2)(x^2-2x+4)}=\frac{5x^2-10x+20+2x+4-60}{(x+2)(x^2-2x+4)}$$
$$=\frac{5x^2-8x-36}{(x+2)(x^2-2x+4)}=\frac{(x+2)(5x-18)}{(x+2)(x^2-2x+4)}=\frac{5x-18}{x^2-2x+4}$$