Math 120 Exam #1 Key (Spring 2011)

1. $p^2 - q = (-3)^2 - 7 = 9 - 7 = 2$

2a. $w^3 - 7w^3 - 2w^2 + 11w^2 + 5 = -6w^3 + 9w^2 + 5$

2b. $6t^2 + 11t - 10$

2c. $(3z - a)(3z - a) = 9z^2 - 3az - 3az + a^2 = 9z^2 - 6az + a^2$

3. Apply long division to get: $(2z^2 + z - 2) + \dfrac{6}{3z + 2}$

4a. $x^2 + xy - 5x - 5y = x(x + y) - 5(x + y) = (x + y)(x - 5)$

4b. $(4h - 7)(2h + 3)$

4c. $(3y^3)^3 + (2z)^3 = (3y^3 + 2z)\left[(3y^3)^2 - (3y^3)(2z) + (2z)^2\right] = (3y^3 + 2z)(9y^6 - 6y^3z + 4z^2)$

4d. $(3v^2 - 1)(2v^2 + 3)$

5. $\dfrac{3r^2(r-3)}{(r-3)(r+3)} \cdot \dfrac{r+3}{8r^3} = \dfrac{3}{8r}$

6. $\dfrac{\dfrac{1}{p} + \dfrac{1}{q}}{1 - \dfrac{1}{pq}} \cdot \dfrac{\dfrac{pq}{1}}{\dfrac{pq}{1}} = \dfrac{q + p}{pq - 1}$

7. $\dfrac{8}{2} \cdot \dfrac{y^6}{y^{-4}} \cdot \dfrac{p^{-3}}{p^{-1}} = \dfrac{4y^{10}}{p^2}$

8a. $\sqrt[3]{72} = \sqrt[3]{8 \cdot 9} = 2\sqrt[3]{9}$

8b. $\sqrt{18x^5z^8} = \sqrt{9 \cdot 2 \cdot x^4 \cdot x \cdot z^8} = 3x^2z^4\sqrt{2x}$

8c. $\sqrt{\dfrac{2}{3x}} = \dfrac{\sqrt{2}}{\sqrt{3x}} \cdot \dfrac{\sqrt{3x}}{\sqrt{3x}} = \dfrac{\sqrt{6x}}{3x}.$

8d. $2\sqrt[3]{3} + 4\sqrt[3]{24} = 2\sqrt[3]{3} + 8\sqrt[3]{3} = 10\sqrt[3]{3}.$

9. Simplifying yields $8x + 56 = 8x + 49$, which leads to $56 = 49$ and is therefore a contradiction. Solution set is the empty set: $\varnothing$.

10. $h = \dfrac{S - 2\pi r^2}{2\pi r}$

11. Let w be the width. Then length is $2w - 10$ and we get $2w + 2(2w - 10) = 310$. Solving gives $w = 55$, so width is 55 cm and length is 100 cm.

12.

	rate	time	distance
Bike	r	$\frac{3}{4}$	$\frac{3r}{4}$
Car	r+4.5	$\frac{1}{3}$	$\frac{r+4.5}{3}$

Note the time should be entered in hours. The distances must be equal, so we have $\dfrac{3r}{4} = \dfrac{r + 4.5}{3}$, which solves to give us $r = 3.6$ mi/hr for the bike speed. Thus the distance to work is $3(3.6)/4 = 2.7$ miles.

13. $-2 + 16i$

14. $\dfrac{1+2i}{1-3i} \cdot \dfrac{1+3i}{1+3i} = \dfrac{1+3i+2i+6i^2}{1+3i-3i-9i^2} = \dfrac{-5+5i}{10} = -\dfrac{1}{2} + \dfrac{1}{2}i.$