2003 MCAS Alternate Assessment/MCAS Performance Appeals
WORK DESCRIPTION for Grade 10 Competency in
MATHEMATICS

[THE ATTACHED STUDENT WORK SAMPLES WERE TAKEN FROM SEVERAL PORTFOLIOS THAT SCORED "NEEDS IMPROVEMENT"]

The attached pieces of evidence address the following strands and learning standards:

| X | Number Sense and Operations | X | 10.N.1 | □ | 10.N.2 |
Indentify the properties of the following and demonstrate how they work:

1. \(5 + (6+3) = (5+6) + 3\)
   \[\checkmark \quad 5 + 9 = 14 \quad \checkmark \quad 5 + 6 = 11 + 3 = 14 \quad \checkmark \quad 14 = 14\]

   \(\text{associative (addition)}\)

2. \(6(5) = 5(6)\)
   \[\checkmark \quad \checkmark \quad 30 = 30\]

   \(\text{x associative (multiplication)}\)

3. \(4 + 5 = 5 + 4\)
   \[\checkmark \quad 9 = 9\]

   \(\text{commutative (addition)}\)

4. \(4(3 + 2) = 4(3) + 4(2)\)
   \[\checkmark \quad 4 \times 5 = 20 \quad \checkmark \quad 12 + 8 = 20 \quad \checkmark \quad 20 = 20\]

   \(\text{distributive}\)

5. \(4(6 \times 2) = (4 \times 6) \times 2\)
   \[\checkmark \quad \checkmark \quad 48 = 48 \quad \checkmark \quad 13 + 2 = 15\]

   \(\text{associative (multiplication)}\)

6. \((10 + 2) + 3 = (10 + 3) + 2\)
   \[\checkmark \quad 12 + 3 = 15 \quad \checkmark \quad 15 = 15\]

   \(\text{associative (addition)}\)
A. Define additive inverse and multiplicative inverse:

Additive inverse is when you add any number to get 0. Multiplicative inverse is when you multiply a number by its fraction to get 1.

B. State the additive inverse of each of the following:

1. $-3 + 3 = 0$
2. $5 + -5 = 0$
3. $6 + -6 = 0$
4. $-10 + 10 = 0$
5. $-8 + 8 = 0$
6. $7 + -7 = 0$

C. State the multiplicative inverse of the following:

1. $4 \times \frac{1}{4} = 1$
2. $6 \times \frac{1}{6} = 1$
3. $\frac{1}{8} \times 8 = 1$
4. $\frac{1}{6} \times 6 = 1$
5. $-8 \times \frac{1}{8} = 1$
6. $-10 \times \frac{1}{10} = 1$
D. Solve

1. \(3^2 = 3 \times 3 = 9\) \[\checkmark\]

2. \(\sqrt{16} = 4\) \[\checkmark\]

3. \(\sqrt[3]{8} = 2\) \[\checkmark\]

4. \(2^4 = 2 \times 2 \times 2 \times 2 = 16\) \[\checkmark\]

5. \(\sqrt{36} = 6\) \[\checkmark\]

E. Convert the following to radicals:

1. \(4^{1/2} = \sqrt[2]{4}\) \[\checkmark\]

2. \(5^{2/3} = \sqrt[3]{5^2}\)

3. \(6^{1/4} = \sqrt[4]{6}\)

4. \(7^{3/4} = \sqrt[4]{7^3}\)
Directions: State which property or relationship is demonstrated in each example.

10. \[(5 + 6) + 7 = (6 + 5) + 7\]
   - Associative prop of add
   - Commutative prop of add

12. \[10 + 0 = 10\]
   - Identity prop. of add

13. \[(6 \cdot 8) \cdot 9 = 6 \cdot (8 \cdot 9)\]
   - Associative prop of mult

15. \[10 + 8 = 18 \Rightarrow 18 - 8 = 10\]
   - Inverse prop of add/sub

17. \[10 \cdot 1 = 10\]
   - Identity prop of mult

18. \[3 \cdot (4 + 5) = 3 \cdot 4 + 3 \cdot 5\]
   - Inverse prop of mult/ add
   - Distributive prop

20. \[7 \cdot 7 = 7 \cdot 2\]
   - Commutative prop of mult

21. \[7 + (9 + 6) = (7 + 9) + 6\]
   - Associative prop of add

22. \[4^3 = 64 \Rightarrow \sqrt[3]{64} = 4\]
   - Inverse prop of powers/numbers
6. The inverse of addition is subtraction
   \[ 10 + 8 = 18 \quad 18 - 8 = 10 \swarrow \]

7. Commutative property of addition
   \[ 5 + 6 = 6 + 5 \swarrow \]

8. The inverse of squaring is square rooting
   \[ 5^2 = 25 \quad \sqrt{25} = 5 \swarrow \]
   \[ 25^{\frac{1}{2}} = 5 \swarrow \]

9. Associative property of multiplication
   \[ (2 \cdot 3) \cdot 5 = 2 \cdot (3 \cdot 5) \swarrow \]

10. The inverse of multiplication is division
    \[ 20 \div 2 = 10 \quad 10 \cdot 2 = 20 \swarrow \]
Directions: Please write an example that displays each one of the following properties or relationships.

1. Distributive Property of Multiplication over addition
   \[ 4 \times (6+7) = 4 \times 6 + 4 \times 7 \]
   \[ 4 \times (6+7) \checkmark \]

2. Identity property of Addition
   \[ 8 + 0 = 8 \checkmark \]

3. Commutative property of Multiplication
   \[ 5 \times 2 = 2 \times 5 \checkmark \]

4. Associative property of Addition
   \[ 6 + (4+3) = (6+4)+3 \checkmark \]

5. Identity property of Multiplication
   \[ 5 \times 1 = 5 \checkmark \]
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<td><strong>Patterns, Relations, and Algebra</strong></td>
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Combine Like Terms:

1. $7w^4 + 9w^4 = \sqrt{16}w^4$

2. $4w^3 + (-w^3) = 3w^3$

3. $-3k - 8k = -5k$

4. $4p^2 + 3p^2 = 7p^2$

5. $6x^2 + 3x^4 + 9x^2 + 3 = 5x^2 + 3x + 3$

6. $10x^4 + 6x + 7y^2 - 4x^4 + 3x + 9x = 6x^4 + 6x + 7y^2 + 3x + 9x$

7. $3x^2 + 4x - 3x + 9 - 4x^2 - 10 = \frac{3x^2 + 4x^2}{3x^2 + 4x^2} = \sqrt{2}$

8. $2x^5 + 3x^4 + 2x^3 - 3x + 5x + 6 = \frac{3x^4 + 2x^4}{3x^4 + 2x^4} = 5x^4$

9. $0 + 2.8^5 = 8.5$

Score: 8/9
Student's Name

Date: 4/8/03
Score: 94

A. FOIL

1. \((x - 3)(x + 4)\)
   \[x^2 + 4x - 3x + 12\]
   \[x^2 + x + 12\]

2. \((2x - 6)(x - 4)\)
   \[2x^2 - 12x - 8x + 24\]
   \[2x^2 - 20x + 24\]

3. \((x - 2)(x + 8)\)
   \[x^2 + 8x - 2x - 16\]
   \[x^2 + 6x - 16\]

4. \((3x + 1)(x + 4)\)
   \[3x^2 + 12x + x + 4\]
   \[3x^2 + 13x + 4\]

B. Factor the following. Check using FOIL then solve for x:

1. \(x^2 + 3x + 2 = 0\)
   \[(x + 1)(x + 2)\]
   \[x^2 + 2x + x + 2\]
   \[x^2 + 3x + 2\] check

   \((x + 1) = 0\)
   
   \[-1\]

   \(x + 2 = 0\)
   
   \[-2\]

   \(x = -1\)

   \(x = -2\)
2. \( x^2 - 2x - 24 = 0 \)

\[
(x-6)(x+4)
\]

\( x^2 + 4x - 6x - 24 \)

\( x^2 + 2x - 24 \) check

\[
\frac{24}{2\times12=10} \quad \frac{6\times4=24}{8\times3=24}
\]

\( (x-6)=0 \)

\( +6+6 \)

\( x=6 \) \( \checkmark \)

\( (x+4)=0 \)

\( -4 \)

\( x=-4 \)

3. \( 2x^2 + x - 6 = 0 \)

\[
(2x-3)(x+2)
\]

\( 2x^2 + 4x - 3x - 6 \)

\( 2x^2 + 1x - 6 \) check

\[
\frac{6}{(2x-3)=0} \quad \frac{3\times2=6}{6\times1=6}
\]

\( x=3 \) \( 2\times3=6 \)

\( -3 \times \frac{1}{6} = -1 \times 6 = -6 \)

\( 1\times6 = -6 \)

4. \( 3x^2 + 5x - 2 = 0 \)

\[
\frac{2}{1\times2=1} \quad \frac{3x-1}{2x=15}
\]

\( 3x^2 + 6x - 1x - 2 \)

\( (3x-1)=0 \)

\( +1+1 \)

\( 3x^2 + 5x - 2 \) check

\[
\frac{(x+2)}{x=-2} \quad \frac{(x+2)}{x=1} \quad \frac{3x-1}{x=1}
\]

\( x=-2 \)

\( \checkmark \)

Same for 1
Alternative Methods of Factoring

A. Solve by completing the square

1. $x^2 - 8x = 9$

   \[
   \left( \frac{-8}{2} \right)^2 = -4^2 = 16
   \]

   \[
   \sqrt{x^2 - 8x + 16} = 9 + 16
   \]

   \[
   (x - 4)^2 = \sqrt{25}
   \]

   \[
   x - 4 = 5 \quad x - 4 = -5
   \]

   \[
   +4 +4 \\
   \underline{+4 +4}
   \]

   \[
   x = 9 
   \]

2. $3x^2 + 6x - 9 = 0$

   \[
   \sqrt{x^2 + 2x - 3 = 0}
   \]

   \[
   \sqrt{1^2 + 3} = 1
   \]

   \[
   \left( \frac{3}{3} \right)^2 = 1^2 = 1
   \]

   \[
   x^2 + 2x + 1 = 3 + 1
   \]

   \[
   (x + 1)(x + 1) = \sqrt{4}
   \]

   \[
   x + 1 = 4 \quad x + 1 = -4
   \]

   \[
   -1 -1 \\
   \underline{-1 -1}
   \]

   \[
   x = 3 
   \]

   \[
   x = -5
   \]
B. Use the quadratic equation to solve the following:

1. \( x^2 - 5x + 6 = 0 \)

\[
A \frac{B}{c} \quad x = 5 \pm \sqrt{5^2 - 4 \cdot 1 \cdot 6} \\
A \quad x = 5 \pm \sqrt{25 - 24} \\
A \quad x = 5 \pm 1 \\
A \quad \frac{5 + 1}{2} = 3 \quad \frac{5 - 1}{2} = 2
\]

\( x = 3, 2 \)

2. \( 3x^2 + 8x + 4 = 0 \)

\[
A \quad x = 8 \pm \sqrt{8^2 - 4 \cdot 3 \cdot 4} \\
A \quad x = 8 \pm \sqrt{64 - 48} \\
A \quad x = \frac{8 + 4}{6} = 2 \quad \frac{8 - 4}{6} = 3
\]

3. \( 6x^2 + 21x - 12 = 0 \)

\[
A \quad x = 21 \pm \sqrt{21^2 - 4 \cdot 6 \cdot (-12)} \\
A \quad x = 21 \pm \sqrt{441 + 288} \\
A \quad 21 + 27 = 48 \\
A \quad \frac{21 - 27}{6} = -1
\]
C. Demonstrate equivalence using factoring, completing the square and the quadratic equation to solve

1. \( x^2 + 4x + 4 = 0 \)

\[ x^2 + 3x + 2 = 0 \]

2. \( 2x^2 - 3x - 35 = 0 \)
\( (x + a)(x + a) = 0 \)

\[ x + a = 0 \]
\[ x = -a \]

\( x^2 + 4x = -y \)
\[ \left( \frac{y}{2} \right)^2 = -a^2 = y \]
\[ x^2 + 4x + y = -y + y \]
\[ (x + a)(x + a) = 0 \]
\[ x + a = 0 \]
\[ x = -a \]
Quadratic

\[-y = \sqrt{y^2 - 4(1)(y)}\]
\[\frac{-y}{2(1)}\]
\[-y = \sqrt{0}\]
\[\frac{2}{2}\]
\[-y + 0\]
\[\frac{-y + 0}{2}\]
\[-y = 0\]
\[ x^2 + 3x + 2 = 0 \]

Factor:
\[
\begin{align*}
(x + 2)(x + 1) &= 0 \\
(x + 2) &= 0 \\
&

-2 &

\hline
x &= -2

(x + 1) &= 0 \\
&

-1 &

\hline
x &= -1
\end{align*}
\]

Completing the Square:
\[
\begin{align*}
x^2 + 3x &= -2 \\
x^2 + 3x + 2.25 &= -2 + 2.25 \\
(x + 1.5)(x + 1.5) &= 0.25 \\
x + 1.5 &= \pm 0.5
\end{align*}
\]

\[
\begin{align*}
x + 1.5 &= 0.5 \\
&

+ 1.5 & \quad - 1.5 \\
\hline
x &= -1

x + 1.5 &= -0.5 \\
&

- 1.5 & \quad - 1.5 \\
\hline
x &= -2
\end{align*}
\]

\[
-3 \pm \sqrt{3^2 - 4(1)(2)} \\
\pm \frac{\sqrt{1}}{2}
\]

\[
\begin{align*}
x &= -2, -1
\end{align*}
\]
10. P. 5

Solve by factoring

1. \(x^2 + x = 0\)
   \(x(x+1) = 0\)
   \(x = -1, 0\)

2. \(x^2 - 3x = 0\)
   \(x(x-3) = 0\)
   \(x = 0, 3\)

3. \(x^2 - 5x = 0\)
   \(x(x-5) = 0\)
   \(x = 0, 5\)

4. \(6x + 2x^2 = 0\)
   \(x(6+2x) = 0\)
   \(x = 0, -3\)

5. \(x^2 + 4x + 3 = 0\)
   \((x+3)(x+1) = 0\)
   \(x = -3, -1\)

6. \(x^2 + 8x + 15 = 0\)
   \((x+3)(x+5) = 0\)
   \(x = -3, -5\)

7. \(x^2 + x - 6 = 0\)
   \((x-2)(x+3) = 0\)
   \(x = -2, 3\)

8. \(x^2 + 10x + 25 = 0\)
   \((x+5)^2 = 0\)
   \(x = -5\)

Solve using the quadratic formula

9. \(x^2 + 18x + 36 = 0\)

\[
\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}
\]

\[
\frac{-12 \pm \sqrt{144-144}}{2a}
\]

\(x = -6\)

10. \(x^2 + 5x - 24 = 0\)

\[
\frac{-5 \pm \sqrt{25-4(1)(24)}}{2a}
\]

\[
\frac{-5 \pm 11}{2a}
\]

\(x = 3, -8\)
Solve by completing the square.

\[ x^2 - 4x + 2 = 0 \]
\[ x^2 - 4x + 4 = 2 \]
\[ \sqrt{(x-2)^2} = \sqrt{2} \]
\[ x - 2 = \pm \sqrt{2} \]
\[ x = 2 \pm \sqrt{2} \]

\[ x^2 + 10x + 24 = 0 \]
\[ x^2 + 10x + 25 = 1 \]
\[ \sqrt{(x+5)^2} = 1 \]
\[ x + 5 = \pm 1 \]
\[ -5 = \pm 1 \]
\[ x = -4, -6 \]
10.1 F.5

Solve the equation using both the factoring method and the quadratic formula.

\[ x^2 + 8x + 16 = 0 \]

\[ (x+4)(x+4) = 0 \]

\[ x = 4 \]

\[ x = \frac{-8 \pm \sqrt{64-64}}{2} \]

\[ = \frac{-8}{2} = -4 \]

\[ x^2 + 16x + 64 = 0 \]

\[ (x+8)(x+8) = 0 \]

\[ x = -8 \]

\[ x = \frac{-16 \pm \sqrt{256-256}}{2} \]

\[ = \frac{-16}{2} = -8 \]

Are your answers, using the two methods, the same or different?

SAME
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A. Calculate the surface area, lateral surface area and volume:

1. A plastic ball with a diameter of six inches.

   S.A. = \(4 \pi r^2\)

   \[
   V = \frac{4}{3} \pi r^3
   \]

   \[
   \frac{4}{3} (3.14) (3^3) = 113.1 \text{ in}^2
   \]

   \[
   \frac{4}{3} (3.14) (3^3) = 339 \text{ in}^3
   \]

2. A square prism:

   \[6 \text{ in.}\]

   \[L.A. = 4 s^2\]

   \[V = s^3\]

   \[
   4 (6^2) = 144 \text{ in}^2
   \]

   \[
   6 (6^2) = 216 \text{ in}^3
   \]

   \[6^3 = 6 \times 6 \times 6 = 216 \text{ in}^3\]
3. A cylinder:

\[ r = 4 \text{ ft} \]
\[ h = 9 \text{ ft} \]

L.A. = \( 2\pi rh \)
\[ 2(3.14)(4)(9) = \boxed{226 \text{ ft}^2} \]

S.A. = \( 2\pi r^2 + 2\pi rh \)
\[ 2(3.14)(4^2) + 2(3.14)(4)(9) = \boxed{326 \text{ ft}^2} \]

\[ \pi r^2h \]
\[ 3.14 \times 16 \times 9 = \boxed{452 \text{ ft}^3} \]

4. An ice cream cone with a diameter of 5 cm, a height of 12 cm and a slant height of 13 cm.

L.A. = \( \pi rl \)
\[ 3.14 \times (2.5)(13) = \boxed{102 \text{ cm}^2} \]

S.A. = \( \pi r^2 + \pi rl \)
\[ 3.14 \times (2.5^2) + 3.14 \times 2.5 \times 13 \]
\[ V = \frac{1}{3} \pi r^2h \]
\[ \frac{1}{3} (3.14)(2.5^2)(12) = \boxed{79 \text{ cm}^3} \]
5. A square pyramid:

\[ L.A. = 2 \times s \times l \]
\[ 2(3)(6) = 36 \text{ in}^2 \]
\[ S.A. = s^2 + 2 \times l \]
\[ 3^2 + 2(3)(6) = 45 \text{ in}^2 \]
\[ V = \frac{1}{3} s^2 h \]
\[ \frac{1}{3}(3^2)(3) = 9 \text{ in}^3 \]

B. When given one dimension find a second:

1. The lateral surface area of a cube is 36 cm². What is the total surface area of the cube?

\[ \sqrt{S^2} = \frac{36}{4} \]
\[ \sqrt{S^2} = 9 \]
\[ \frac{S}{3} = 3 \]
\[ T.SA = 6s^2 \]
\[ 6(3^2) = 54 \text{ cm}^2 \]

2. The volume of a right circular cylinder is \(24\pi \text{ ft}^3\). What is the lateral surface area given a height of 6 ft?

\[ V = 2\pi r^3 \]
\[ h = 6 \text{ ft} \]
\[ \pi r^2 h = 24\pi \text{ ft}^3 \]
\[ 3.14r^2(6) = 24\pi \]
\[ \frac{19}{\pi} \]