Well done Mr. S. !!

Central Peel Secondary School

MCR3U9 **Unit 0 Quest**

Category	Mark
Knowledge	50 /50
Communication	**LEVEL**

Name Mr. Solutions

Date Friday, September 16, 2016

1. Expand and simplify

a) $3x(x+y)-6y(x-2y)$

$=3x^2+3xy-6xy+12y^2$ ✓

$=3x^2-3xy+12y^2$ ✓

[3]

b) $(4a-2b)(6a+5b)$

$=24a^2+20ab-12ab-10b^2$ ✓

$=24a^2+8ab-10b^2$ ✓

[2]

2. Solve and Check

$\frac{x-2}{4}-\frac{x+1}{3}=1$

$\therefore 12\left(\frac{x-2}{4}-\frac{x+1}{3}\right)=12(1)$ ✓

$\therefore 3(x-2)-4(x+1)=12$

$\therefore 3x-6-4x-4=12$ ✓

$\therefore -x-10=12$

$\therefore -x=22$

$\therefore x=-22$ ✓

[4]

CHECK:

$L.S.=\frac{-22-2}{4}-\left(\frac{-22+1}{3}\right)$

$=\frac{-24}{4}-\left(\frac{-21}{3}\right)$

$=-6+7$ ✓

$=1$

$=R.S.$

3. For the following function below, state the vertex, equation of the axis of symmetry, the maximum or minimum value, y-intercept, values x variable may take and values y variable may take.

$y=-4x^2+8x-2$

$\therefore y=-4(x^2-2x)-2$

$=-4(x^2-2x+1-1)-2$

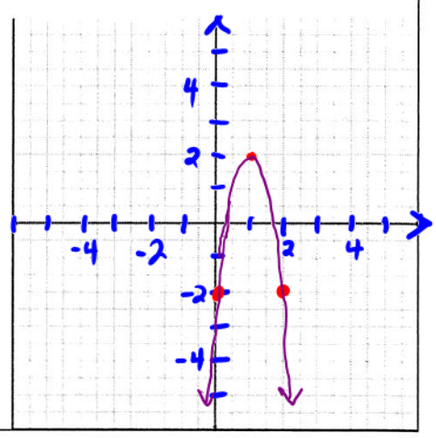
$=-4(x^2-2x+1)+4-2$ ✓✓

$=-4(x-1)^2+2$

vertex: $(1,2)$ ✓ y-int $=-2$ ✓

axis of sym: $x=1$ ✓ Domain $=\mathbb{R}$ ✓

max value $=2$ ✓ Range $=\{y\in\mathbb{R}\mid y\leq 2\}$ ✓



[8]

4. Factor

a) $9x^2y+6xy^3-3x^3y^4$

$=3xy(3x+2y^2-x^2y^3)$ ✓✓

[2]

b) $y^2-8y+15$

$=(y-5)(y-3)$ ✓

[1]

c) $49b^4-25c^2$

$=(7b^2-5c)(7b^2+5c)$ ✓✓

[2]

d) $12p^3-21p^2+28p-49$

$=3p^2(4p-7)+7(4p-7)$

$=(4p-7)(3p^2+7)$ ✓✓

[2]

5. Solve, using the **appropriate** method. Provide **exact** solutions.

a) $10x^2-21x+9=0$

$\therefore 10x^2-15x-6x+9=0$ ✓

$\therefore 5x(2x-3)-3(2x-3)=0$ ✓

$\therefore (2x-3)(5x-3)=0$ ✓

$\therefore 2x-3=0$ or $5x-3=0$ ✓

$\therefore x=\frac{3}{2}$ or $x=\frac{3}{5}$ ✓

[4]

b) $-5x^2=2x-2$

$\therefore -5x^2-2x+2=0$ ✓

$\therefore x=\frac{2\pm\sqrt{(-2)^2-4(-5)(2)}}{2(-5)}$ ✓

$=\frac{2\pm\sqrt{44}}{-10}$ ✓

$=\frac{2\pm 2\sqrt{11}}{-10}=-\frac{1\pm\sqrt{11}}{5}$ ✓

[4]

6. A quadratic expression of the form $x^2 + 10x + c$ can be factored in the form $(x + a)(x + b)$, where a and b are whole numbers. Another quadratic expression of the form $x^2 + 12x + d$ can be factored in the form $(x + e)(x + f)$, where e and f are whole numbers. Which do you think is greater: c or d? Why?

[3]

$(x+a)(x+b) = x^2+(a+b)x+ab$
$(x+e)(x+f) = x^2+(e+f)x+ef$
$\therefore c = ab,\ d = ef,\ a+b = 10$ ✓
and $e+f = 12$
$\therefore$ max values of c and d respectively are ✓
$5(5) = 25$ and $6(6) = 36$
$\therefore$ d's max value is greater than c's max value BUT c can be greater than d (e.g. $c = 5(5) = 25$, $d = 1(11) = 11$)

7. For what value(s) of k will the function $2x^2 - 4x + k = 0$ have:
   a. No real roots
   b. one real root?

[2, 1]

a. $D = b^2 - 4ac < 0$
$\therefore (-4)^2 - 4(2)k < 0$ ✓
$\therefore 16 - 8k < 0$
$\therefore 16 < 8k$ ✓
$\therefore 2 < k$ (or $k > 2$)

b. $16 - 8k = 0$
$\therefore k = 2$ ✓

8. A Frisbee is thrown up in the air from a position 2m above the ground. Because of the wind patterns, the height h, in metres after time t, in seconds is given by the formula $h = -2t^2 + 6t + 2$.

a) What is the maximum height of the Frisbee? Present the answer to the nearest tenth.

[2]

$h = -2t^2 + 6t + 2$
$= -2(t^2 - 3t) + 2$
$= -2(t^2 - 3t + (\frac{3}{2})^2 - (\frac{3}{2})^2) + 2$ ✓
$= -2(t - \frac{3}{2})^2 + \frac{13}{2}$
Since the vertex of the parabola is $(\frac{3}{2}, \frac{13}{2})$, the maximum height is $\frac{13}{2}$ m. ✓

b) When did it reach the maximum height? Present the answer to the nearest tenth.

[1]

The maximum height was attained at $t = \frac{3}{2}$ s ✓
(vertex → $(\frac{3}{2}, \frac{13}{2})$)

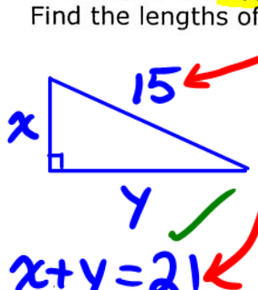
c) If the Frisbee is caught 2 metres above the ground, how long will it have been in the air?

[2]

$h = 2$
$\therefore -2t^2 + 6t + 2 = 2$ ✓
$\therefore -2t^2 + 6t = 0$
$\therefore -2t(t - 3) = 0$
$\therefore -2t = 0$ or $t - 3 = 0$
$\therefore t = 0$ or $t = 3$
$\therefore$ Frisbee was in the air for 3 s ✓ (Obvious because of symmetry of parabola)

9. The length of a hypotenuse of a right triangle is 15 cm. The sum of the other two sides is 21 cm. Find the lengths of the other two sides of the triangle. (**Hint:** Linear-Quadratic System)

[4]



$x + y = 21$
By the Pythagorean Theorem, $x^2 + y^2 = 225$ ✓
Since $y = 21 - x$
$\therefore x^2 + (21 - x)^2 = 225$
$\therefore x^2 + 441 - 42x + x^2 = 225$
$\therefore 2x^2 - 42x + 216 = 0$
$\therefore x^2 - 21x + 108 = 0$
$\therefore (x - 9)(x - 12) = 0$
$\therefore x = 9$ or $x = 12$ ✓
$\therefore$ the other two sides have lengths 9 cm and 12 cm

10. What does it mean solve a linear system (i.e. a system of linear equations)? How is such a system solved?

[2]

For a system of 2 linear equations in 2 unknowns x and y, this means to find values of x and y that satisfy BOTH equations. Such a system can be solved by ✓ eliminating one of the unknowns. This is equivalent to finding the point of intersection of the lines represented by the equations.