MPM2D – Exam Review – Units 1 – 3

Unit 1 – Powers and Polynomials

1. For each polynomial below, state the degree and the type of polynomial.

Polynomial	Degree of Polynomial	Type of Polynomial
$5x^2 - 8x + 11$	2	trinomial
$x^2y^3 + 9x^3y^3 + 17xy^2 + 145$	6	polynomial
$22x^4y^4z$	9	monomial
$86x - 78y^2$	2	binomial

2. Identify the numerical and literal coefficient of each term.

Term	Numerical Coefficient	Literal Coefficient
$99x^2y$	99	x^2y
$-a^2b^3c^4$	-1	$a^2b^3c^4$
125	125	none

3. Expand and simplify.

a. $(2y^2 - 2y + 1) + (4y^2 - y - 4)$

b. $(2x^2 - 3x - 5) - (2x^2 + 4x - 7)$

c. $4x(2x - 3) - x(3x - 1)$

d. $(x - 4)(x + 7)$

e. $(5a + 2b)(3a - 4b)$

f. $-5(x - 6)(2x + 7)$

g. $(x + 3)^2$

h. $-4(y - 2)^2$

i. $-3(x - 7)^2 + 11$

j. $y = \frac{1}{4}(x+6)^2 - 20$

4. Simplify each of the expressions below. Write all final answers with positive exponents.

   a. $(3x^{-3})^{-2}$

   b. $(2a^4b^{-2}c^3)^5$

   c. $3x^2yz^{-4}(16x^{-3}yz^8)$

   d. $-\dfrac{44x^9y^8z^3}{11x^7y^{10}z^2}$

   e. $\dfrac{5a^{10}b^{12}c}{105a^{-3}b^9}$

   f. $\dfrac{(4ac^2)(5a^3b^{-4}c^{11})^2}{10a^7b^{-7}c^7}$

5. Simplify each expression below using the power laws. Evaluate if possible.

   a. $10x^0$

   b. -12^3

   b. $(2y^{-5})^3$

   d. $\left(\dfrac{8}{9}\right)^{-2}$

   e. $\left(\dfrac{3x^4}{y^6}\right)^4$

   f. $\left(-\dfrac{3}{4}\right)^{-5}$

   g. $2^{-2}+4^{-2}$

   h. $(11x^{-3})^{-2}$

6. In baseball, the second base bag is a square. Its side length can be represented by the expression 5x+3.
   a. Write and expand an expression to represent the area of the top of the bag.
   b. If x represents 7 cm, what is the area of the top of the bag?

Unit 2 – The Quadratic Relation

1. Find the vertex, equation of axis of symmetry, the direction of opening, and the maximum/minimum value of each parabola. Use this information to sketch the graph.

   a. $y = x^2 - 7$

   b. $y = (x - 3)^2$

   c. $y = -(x + 1)^2 + 10$

   d. $y = 3x^2 - 12$

   e. $y = -\frac{1}{2}(x + 2)^2 - 3$

   f. $y = -4(x - 1)^2 + 4$

2. Find the equation of a quadratic relation in vertex form that:

   a. has vertex (–6, 0) and passes through (–3, 27)

   b. has vertex (3, 7) and has a y-intercept of –8

   c. has vertex (4, –2), opens down and is congruent to $y=3x^2$

3. Determine the number of x-intercepts in each quadratic relation below.

a. $y = \frac{1}{2}(x-11)^2 + 12$

b. $y = -7(x-8)^2 + 13$

c. $y = 2(x-4)^2$

d. $y = 5x^2 - 6$

4. Graph each of the quadratic relations below on the grid provided.

V (0,8)

a. $y = -x^2 + 8$

V(-6,0)

b. $y = (x+6)^2$

V(7,-2)

c. $y = \frac{1}{2}(x-7)^2 - 2$

a)

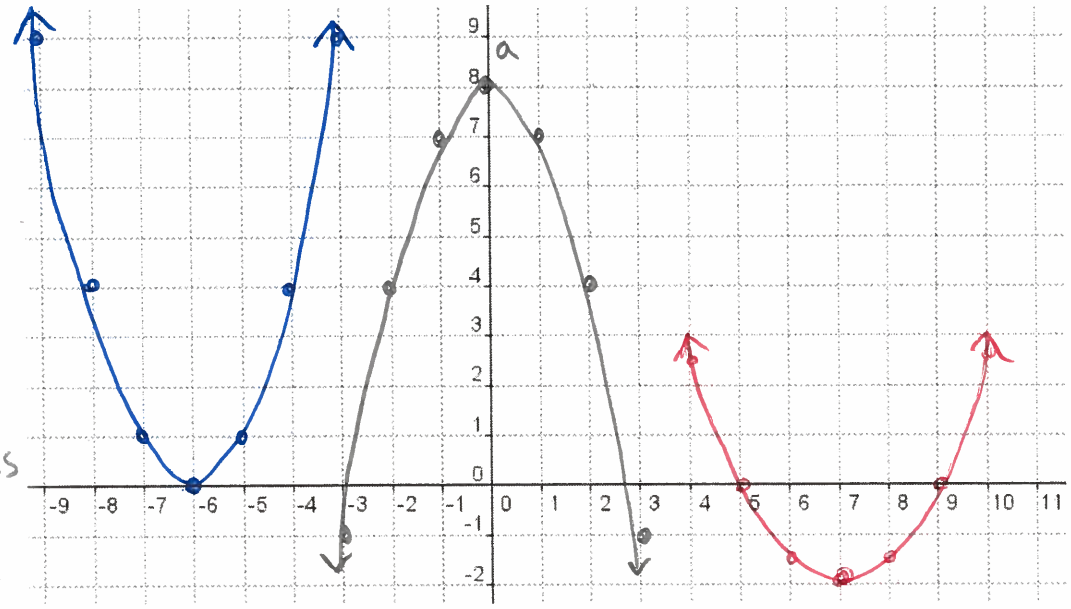
x	y
1	1(-1) = -1
2	4(-1) = -4
3	9(-1) = -9

b)

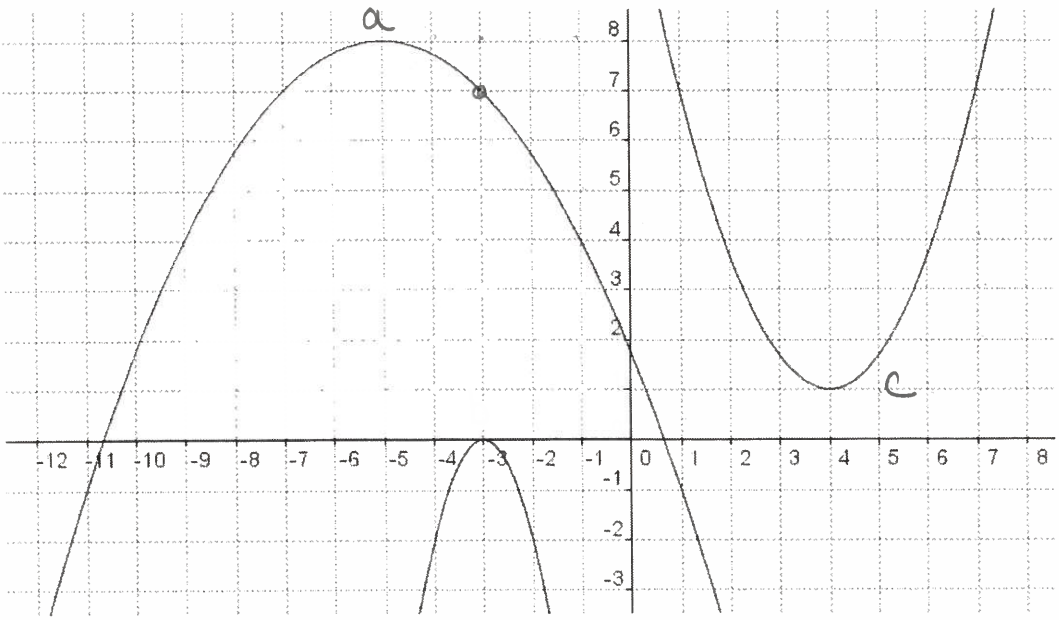
x	y
1	1
2	4
3	9

c)

x	y
1	1(1/2) = 0.5
2	4(1/2) = 2
3	9(1/2) = 4.5



5. Determine the equation for each quadratic relation shown below.



Unit 3 – Factoring

1. Factory each expression below completely. If it is not factorable, prove that it cannot be factored.

a. $2ab - 6a^2b + 12ab^3$

b. $3(x + 4) - x(x + 4)$

c. $x^2 + 4x - 21$

d. $y^2 - 6y - 27$

e. $2x^2 + 10x + 12$

f. $2m^2 - 9m + 4$

g. $5y^2 - 11y + 2$

h. $36a^2 - 49$

i. $1 - 49x^2$

j. $121x^2 - 64b^2$

k. $y^2 - 6y + 9$

l. $4m^2 + 20m + 25$

m. $6x^2 + 3x - 8$

n. $12x^2 + 4x - 5$

Answer Key

Unit 1

1a) 2, trinomial
b) 6, polynomial
c) 9, monomial
d) 2, binomial

2a) 99, x^2y
b) –1, $a^2b^3c^4$
c) 125, none

3a) $6y^2–3y–3$
b) $–7x+2$
c) $5x^2–11x$
d) $x^2+3x–28$

e) $15a^2–14ab-8b^2$
f) $–10x^2+25x+210$
g) x^2+6x+9
h) $–4y^2+16y–16$

i) $-3x^2+42x-136$
j) $¼x^2+3x-11$

4a) $\frac{x^6}{9}$
b) $\frac{32a^{20}c^{15}}{b^{10}}$
c) $\frac{48y^2z^4}{x}$
d) $-\frac{4x^2z}{y^2}$

e) $\frac{a^{13}b^3c}{21}$
f) $\frac{10c^{17}}{b}$

5a) 10
b) –1728
c) $\frac{8}{y^{15}}$
d) $\frac{81}{64}$

e) $\frac{81x^{16}}{y^{24}}$
f) $-\frac{1024}{243}$
g) $\frac{5}{16}$
h) $\frac{x^6}{121}$

6a) $25x^2+30x+9$
b) 1 444 cm^2

Unit 2

	Vertex	Axis of Symmetry	Direction of Opening	Max/Min
a) $y = x^2 - 7$ $y = (x-0)^2 - 7$	(0, –7)	x = 0	Up	Min at y = –7
b) $y = (x-3)^2$	(3, 0)	x = 3	Up	Min at y = 0
c) $y = -(x+1)^2 + 10$	(–1, 10)	x= –1	Down	Max at y = 10
d) $y = 3x^2 - 12$ $y = 3(x-0)^2 - 12$	(0, –12)	x = 0	Up	Min at y = –12
e) $y = -\frac{1}{2}(x+2)^2 - 3$	(–2, –3)	x = –2	Down	Max at y = –3
f) $y = -4(x-1)^2 + 4$	(1, 4)	x = 1	Down	Max at y = 4

2a) $y = 3(x+6)^2$ b) $y = -\frac{5}{3}(x-3)^2 + 7$ c) $y = -3(x-4)^2 - 2$

3a) none b) two c) one
d) two

4.a) V (0, 8), opens down b) V (-6, 0), opens up c) V (7, –2), vertical stretch by a factor of 0.5

5a) $y = -\frac{1}{4}(x+5)^2 + 8$ b) $y = -2(x+3)^2$ c) $y = \frac{2}{3}(x-4)^2 + 1$

Unit 3

1a) $2ab(1-3a+6b^2)$ b) (x+4)(3–x) c) (x+7)(x–3) d) (y–9)(y+3)
e) 2(x+2)(x+3) f) (2m–1)(m–4) g) (5y–1)(y-2) h) (6a–7)(6a+7)
i) (1–7x)(1+7x) or –(7x-1)(7x+1) j) (11x–8b)(11x+8b) k) $(y-3)^2$
l) $(2m+5)^2$ m) prime – see table below n) (6x+5)(2x–1)

P = –48	S = 3
(–1)(48)	47
(–2)(24)	22
(–3)(16)	13
(–4)(12)	8
(–6)(8)	2
(–8)(6)	–2
(–12)(4)	–8
(–16)(3)	–13
(–24) 2)	–22
(–48)(1)	–47

MPM2D - Exam Review - Units 1-3

Unit 1 - Powers & Polynomials

1. on handout

2. on handout

3. $(2y^2-2y+1)+(4y^2-y-4)$
$=2y^2-2y+1+4y^2-y-4$
$=6y^2-3y-3$

b. $(2x^2-3x-5)-(2x^2+4x-7)$
$=2x^2-3x-5-2x^2-4x+7$
$=-7x+2$

c. $4x(2x-3)-x(3x-1)$
$=8x^2-12x-3x^2+x$
$=5x^2-11x$

d. $(x-4)(x+7)$
$=x^2+7x-4x-28$
$=x^2+3x-28$

e. $(5a+2b)(3a-4b)$
$=15a^2-20ab+6ab-8b^2$
$=15a^2-14ab-8b^2$

f. $-5(x-6)(2x+7)$
$=-5(2x^2+7x-12x-42)$
$=-5(2x^2-5x-42)$
$=-10x^2+25x+210$

g. $(x+3)^2$
$=(x+3)(x+3)$
$=x^2+3x+3x+9$
$=x^2+6x+9$

h. $-4(y-2)^2$
$=-4(y-2)(y-2)$
$=-4(y^2-2y-2y+4)$
$=-4y^2+8y+8y-16$
$=-4y^2+16y-16$

i. $-3(x-7)^2+11$
$=-3(x-7)(x-7)+11$
$=-3(x^2-7x-7x+49)+11$
$=-3(x^2-14x+49)+11$
$=-3x^2+42x-147+11$
$=-3x^2+42x-136$

j. $y=\frac{1}{4}(x+6)^2-20$
$=\frac{1}{4}(x+6)(x+6)-20$
$=\frac{1}{4}(x^2+6x+6x+36)-20$
$=\frac{1}{4}(x^2+12x+36)-20$
$=\frac{1}{4}x^2+12x/4+36/4-20$
$=\frac{1}{4}x^2+3x+9-20$
$=\frac{1}{4}x^2+3x-11$

4. $(3x^{-3})^2$
$= 3^{-2}(x^6)$
$= \left(\frac{1}{3}\right)^2 x^6$
$= \frac{x^6}{9}$

b) $(2a^4b^{-2}c^3)^5$
$= 2^5 a^{20} b^{-10} c^{15}$
$= \frac{32a^{20}c^{15}}{b^{10}}$

c) $3x^2yz^{-4}(16x^{-3}yz^8)$
$= 48x^{-1}y^2z^4$
$= \frac{48y^2z^4}{x}$

d) $\frac{-44x^9y^8z^3}{11x^7y^{10}z^2}$
$= -4x^2y^{-2}z$
$= \frac{-4x^2z}{y^2}$

e) $\frac{5a^0b^{12}c}{105a^{-3}b^9}$
$= \frac{1a^{13}b^3c}{21}$
$= \frac{a^{13}b^3c}{21}$

f) $\frac{(4ac^2)(5a^3b^{-4}c^4)^2}{10a^7b^{-7}c^7}$
$= \frac{4ac^2 \cdot 25a^6b^{-8}c^{22}}{10a^7b^{-7}c^7}$
$= \frac{100a^7b^{-8}c^{24}}{10a^7b^{-7}c^7}$
$= 10a^0b^{-1}c^{17}$
$= \frac{10c^{17}}{b}$

5. $10x^0$
$= 10(1)$
$= 10$

b) -12^3
$= -1728$

c) $(2y^{-5})^3$
$= 2^3(y^{-5})^3$
$= 8y^{-15}$
$= \frac{8}{y^{15}}$

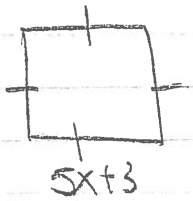
d) $(8/9)^{-2}$
$= (9/8)^2$
$= \frac{81}{64}$

e) $\left(\frac{3x^4}{y^6}\right)^4$
$= \frac{81x^{16}}{y^{24}}$

f) $(-3/4)^{-5}$
$= (-4/3)^5$
$= \frac{(-4)^5}{3^5}$
$= -\frac{1024}{243}$

g) $2^{-2} + 4^{-2}$
$= \left(\frac{1}{2}\right)^2 + \left(\frac{1}{4}\right)^2$
$= 1/4 + 1/16$
$= \frac{4}{16} + \frac{1}{16}$
$= \frac{5}{16}$

h) $(11x^{-3})^{-2}$
$= (11)^{-2}(x^{-3})^{-2}$
$= \left(\frac{1}{11}\right)^2 x^6$
$= \frac{x^6}{121}$

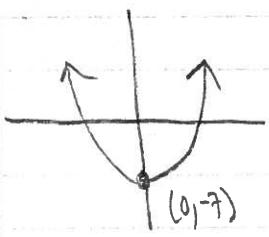
6. 

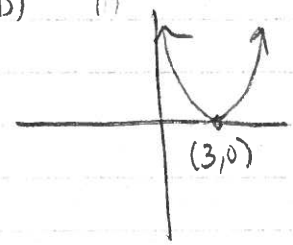
a) $A = lw$
$= (5x+3)(5x+3)$
$= 25x^2 + 15x + 15x + 9$
$= 25x^2 + 30x + 9$ cm²

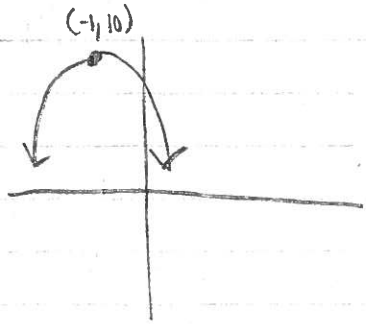
b) $A = 25x^2 + 30x + 9$
$= 25(7)^2 + 30(7) + 9$
$= 25(49) + 210 + 9$
$= 1225 + 210 + 9$
$= 1444$ cm²

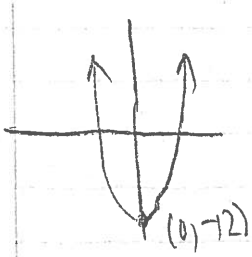
Unit 2 - The Quadratic Relation

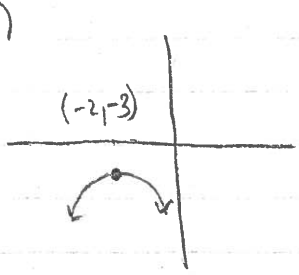
	Eq^n	Vertex	Axis of Sym.	Direc^n of Opening	Max/Min Value
a)	$y = x^2 - 7$	$(0,-7)$	$x = 0$	up	min, $y = -7$
b)	$y = (x-3)^2$	$(3,0)$	$x = 3$	up	min, $y = 0$
c)	$y = -(x+1)^2 + 10$	$(-1,10)$	$x = -1$	down	max, $y = 10$
d)	$y = 3x^2 - 12$	$(0,-12)$	$x = 0$	up	min, $y = -12$
e)	$y = -\frac{1}{2}(x+2)^2 - 3$	$(-2,-3)$	$x = -2$	down	max, $y = -3$
f)	$y = -4(x-1)^2 + 4$	$(1,4)$	$x = 1$	down	max, $y = 4$

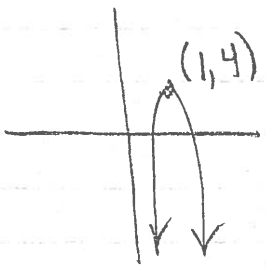
a) 

b) 

c) 

d) 

e) 

f) 

2. vertex $(-6,0)$ $(-3,27)$

$y=a(x-h)^2+k$

$y=a(x+6)^2+0$

$27=a[-3+6]^2+0$

$27=a(3)^2$

$\frac{27}{9}=\frac{9a}{9}$

$a=3$

$y=3(x+6)^2$

b) $V(3,7)$ y-int -8

$(0,-8)$

$y=a(x-h)^2+k$

$y=a(x-3)^2+7$

$-8=a(0-3)^2+7$

$-8=a(-3)^2+7$

$\frac{-15}{9}=\frac{9a}{9}$

$a=-5/3$

$y=-\frac{5}{3}(x-3)^2+7$

c) $V(4,-2)$ down $a=-r$

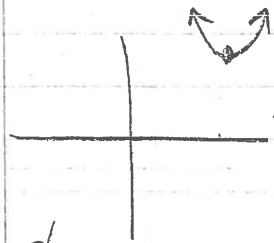
$y=-x^2$ $a=3$

$y=a(x-h)^2+k$

$y=-3(x-4)^2-2$

3. $y=\frac{1}{2}(x-11)^2+12$

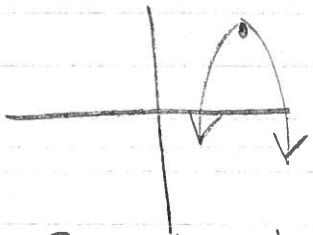
$V(11,12)$ opens ↑



$\emptyset$ x-intercepts

b) $y=-7(x-8)^2+13$

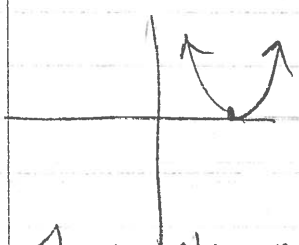
$V(8,13)$ opens ↓



2 x-intercepts

c. $y=2(x-4)^2$

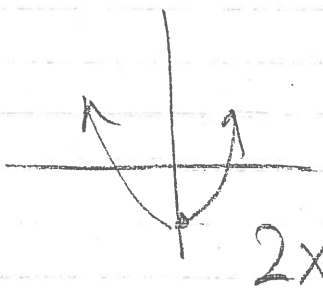
$V(4,0)$ opens ↑



1 x-intercept

d) $y=5x^6-6$

$V(0,-6)$ opens ↑



2 x-intercepts

4. On handout

5. $y = a(x-h)^2+k$
$= -\frac{1}{4}(x+5)^2+8$

$V(-5,8)$ over 2, down 1, over 4, down 4

1	1
2	4 → -1
3	9
4	16 → -4

$a = -1/4$

b. $y = a(x-h)^2+k$
$= -2(x+3)^2$

$V(-3,0)$ over 1, down 2

x	y
1	2

$a = -2$

c. $y = a(x-h)^2+k$
$= \frac{2}{3}(x-4)^2+1$

$V(4,1)$ ∨

1	1
2	4
3	9 6

$6/9 = 2/3$

Unit 3 - Factoring

1. $2ab - 6a^2b + 12ab^3$
$= 2ab(1 - 3a + 6b^2)$

b) $3(x+4) - x(x+4)$
$= (x+4)(3-x)$

c. $x^2 + 4x - 21$
$= (x+7)(x-3)$

d) $y^2 - 6y - 27$
$= (y-9)(y+3)$

e. $2x^2 + 10x + 12$
$= 2(x^2 + 5x + 6)$
$= 2(x+2)(x+3)$

f) $2m^2 - 9m + 4$ $\quad p = 8 \quad s = -9$
$= (2m-1)(m-4)$ $\quad -8, -1$

g. $5y^2 - 11y + 2$ $\quad p = 10 \quad s = -11$ $\quad -10, -1$
$= (5y-1)(y-2)$

h) $36a^2 - 49$ $\quad p = -1764 \quad s = 0$
$\sqrt{36a^2} = 6a$ $\quad 42$
$\sqrt{49} = 7$

i $1 - 49x^2$ $\quad p = 49 \quad s = 0$ $\quad \pm 7$
$= -49x^2 + 1$
$= -(49x^2 - 1)$
$= -(7x-1)(7x+1)$

j) $121x^2 - 64b^2$
$= (11x - 8b)(11x + 8b)$

k) $y^2 - 6y + 9$ $\quad p = 9 \quad s = -6$
$= (y-3)(y-3)$

l) $4m^2 + 20m + 25$ $\quad p = 100 \quad s = 20$ $\quad 10, 10$
$= (2m+5)(2m+5)$

m) $6x^2 + 3x - 8$
prime

$p = -48 \quad s = 3$

p	s
-1, 48	47
-2, 24	22
-3, 16	13
-4, 21	17
-6, 8	2
-8, 6	-2
-16, 3	-13
-21, 4	-17
-24, 2	-22
-48, 1	-47

n) $12x^2 + 4x - 5$ $\quad p = -60 \quad s = 4$ $\quad -6, 10$
$= (6x+5)(2x-1)$