SOLUTIONS

MPM2DI_U4_Review

Tue. Nov. 7, 2017

MPM2DI UNIT 4 REVIEW

1. Determine whether each relation is linear or quadratic. Explain. (Hint: Think about 1st/2nd differences or degree).

A.

x	0	1	2	3	4
y	0	1	4	9	16

1st Diff 1 3 5 7
2nd Diff 2 2 2
2nd Diff are constant ∴ Quadratic

B.

x	-4	-2	0	2	4
y	8	2	0	2	8

1st Diff -6 -2 2 6
2nd Diff 4 4 4
2nd Diff are constant ∴ Quadratic

C. $y=-3x+20$

Degree 1
∴ Linear

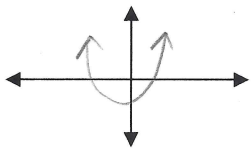
D. $y+3x^2=-4$

$y=-3x^2-4$
Degree = 2 ∴ Quadratic

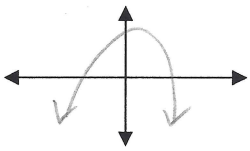
The graph of a quadratic relation, $y=ax^2+bx+c$ is called a parabola.

Every parabola is U- shaped.

If the leading coefficient (a) is positive the parabola will open up. **Ex.** $y=2x^2$



If the leading coefficient (a) is negative the parabola will open down. **Ex.** $y=-3x^2$



2. Determine whether the parabola opens up of down.

A. $y=3x^2+8x+6$
a=3 ∴ opens up

B. $y=x^2+4x-1$
a=1 ∴ opens up

C. $y=-x^2+7x-3$
a=-1 ∴ opens down

D. $y=-8x^2-4$
a=-8 ∴ opens down

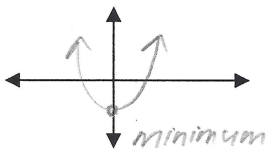
E. $y=-8x+7x^2-3$
a=7 ∴ opens up

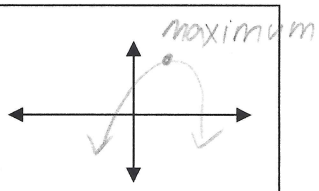
F. $y=9-8x-x^2$
a=-1 ∴ opens down

The vertex is the highest or lowest point on a parabola.

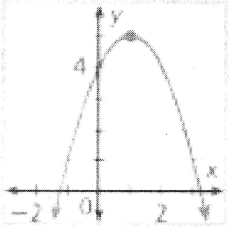
If the parabola opens up, then the vertex is a minimum.

If the parabola opens down, then the vertex is a maximum.



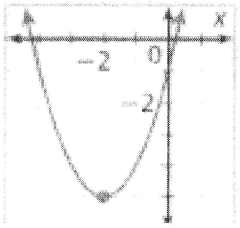


3. Identify the vertex of each parabola. Then give the minimum or maximum value of the relation.



vertex=(1,5)
maximum=5

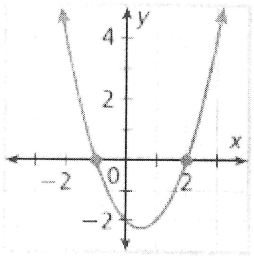
B.



vertex=(-2,-5)
minimum=-5

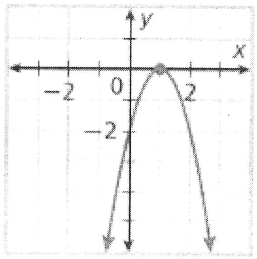
4. State the zeros and equation of the axis of symmetry of each parabola.

$y = x^2 - x - 2$



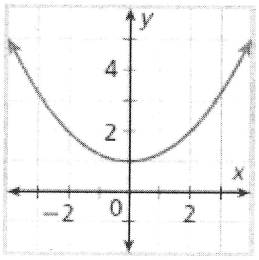
zeros: $x = -1$ and $x = 2$
AofS: $x = 0.5$

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



zeros: $x = 1$
AofS: $x = 1$

$y = \frac{1}{4}x^2 + 1$



zeros: None
AofS: $x = 0$

5. Determine the equation of the axis of symmetry for each graph.

A. $y = x^2 + 4x - 5$ $\quad -1 \quad 5$

$y = (x-1)(x+5)$
zeros: $x = 1$ and $x = -5$
AofS: $x = \frac{1+(-5)}{2}$
$x = -2$

B. $y = x^2 - 3x - 10$ $\quad 1 \quad 2 \quad 10 \quad -5$

$y = (x+2)(x-5)$
zeros: $x = -2$ and $x = 5$
AofS: $x = \frac{-2+5}{2}$
$x = 1.5$

C. $y = x^2 - 13x + 30$ $\quad 1 \quad 2 \quad -3 \quad 5 \quad 30 \quad 15 \quad -10 \quad 6$

$y = (x-3)(x-10)$
zeros: $x = 3$ and $x = 10$
AofS: $x = \frac{3+10}{2}$
$x = 6.5$

. Find the vertex of the graph:

A. $y = x^2 + x - 12$ $\quad 1 \quad 2 \quad 12 \quad 6 \quad -3 \quad 4$

$y = (x-3)(x+4)$ zeros: $x = 3$ and $x = -4$
vertex:
$x = \frac{3+(-4)}{2}$
$x = -0.5$
$y = (-0.5-3)(-0.5+4)$
$y = -12.25$ $\therefore (-0.5, -12.25)$

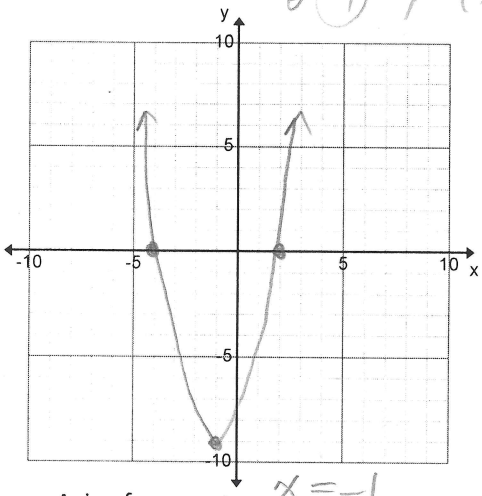
B. $y = -x^2 - 2x$ **** common factor ****

$y = -x(x+2)$
$y = -(x-0)(x+2)$
zeros: $x = 0$ and $x = -2$
vertex: $x = \frac{0+(-2)}{2}$
$x = -1$
$y = -(-1-0)(-1+2)$
$y = 1$ $\therefore (-1, 1)$

7. Graph each quadratic relation.

A. $y = x^2 + 2x - 8$ $\quad 1 \quad -2 \quad 8 \quad 4$

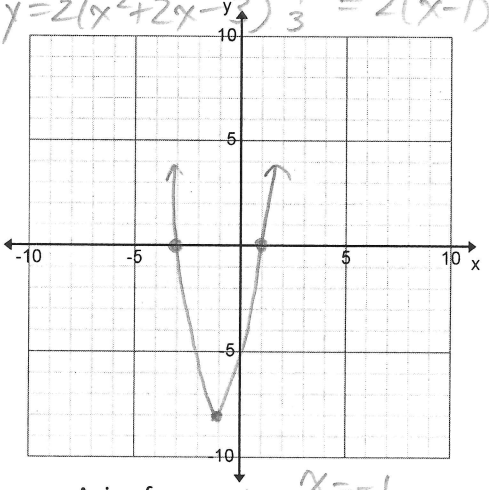
$y = (x-2)(x+4)$



Axis of symmetry $x = -1$
$x = \frac{2+(-4)}{2}$ $y = (-1-2)(-1+4)$ $(-1, -9)$
Vertex: $x = -1$ $y = -9$
Zeros: $x = 2$ and $x = -4$
Opens: up

B. $y = 2x^2 + 4x - 6$ ****common factor****

$y = 2(x^2 + 2x - 3)$ $\quad -1 \quad 3$ $= 2(x-1)(x+3)$

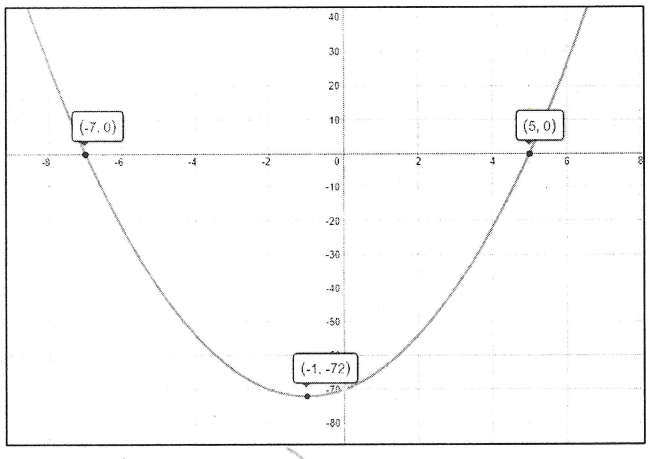


Axis of symmetry $x = -1$
$x = \frac{1+(-3)}{2}$ $y = 2(-1-1)(-1+3)$
Vertex: $x = -1$ $y = -8$ $(-1, -8)$
Zeros: $x = 1$ and $x = -3$
Opens: up

Determining the Equation

8. Use the given information/graph to determine the equation of each quadratic relation in FACTORED FORM and STANDARD FORM.

a)

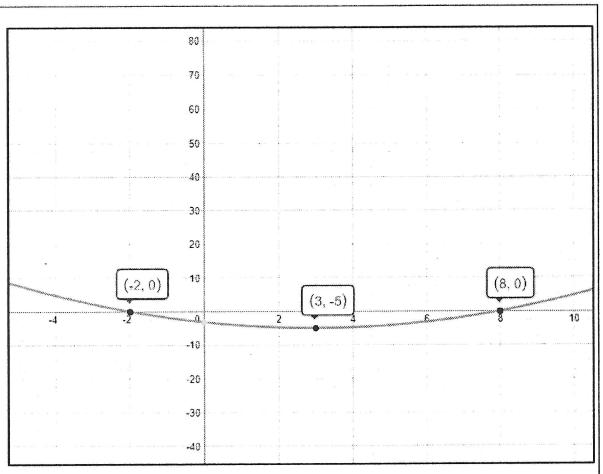


$y = a(x-s)(x-t)$
$-72 = a(-1+7)(-1-5)$
$-72 = a(6)(-6)$
$-72 = -36a$
$2 = a$

$s = -7$
$t = 5$
$x = -1$
$y = -72$

$\therefore y = 2(x+7)(x-5)$ OR
$y = 2(x^2 - 5x + 7x - 35)$
$y = 2x^2 + 4x - 70$

b)



$y = a(x-s)(x-t)$
$-5 = a(3+2)(3-8)$
$-5 = a(5)(-5)$
$\frac{-5}{-25} = \frac{-25a}{-25}$
$1/5 = a$

$s = -2$
$t = 8$
$x = 3$
$y = -5$

$\therefore y = 1/5(x+2)(x-8)$ or
$y = 1/5(x^2 - 8x + 2x - 16)$
$y = 1/5(x^2 - 6x - 16)$
$y = 1/5x^2 - 6/5x - 16/5$

c) Zeros at -6 and 2 and a y-intercept of -9.

$y = a(x-s)(x-t)$
$-9 = a(0+6)(0-2)$
$\frac{-9}{-12} = \frac{a(-12)}{-12}$
$3/4 = a$

$s = -6$
$t = 2$
$x = 0$
$y = -9$

$\therefore y = 3/4(x+6)(x-2)$
$= 3/4(x^2 - 2x + 6x - 12)$
$= 3/4(x^2 + 4x - 12)$
$= 3/4x^2 + 3x - 9$

d) Zeros at -3 and 7 and an optimal value of 4.

$y = a(x-s)(x-t)$
$4 = a(2+3)(2-7)$
$4 = a(5)(-5)$
$\frac{4}{-25} = \frac{-25a}{-25}$
$-4/25 = a$

$\therefore y = -4/25(x+3)(x-7)$
$y = -4/25(x^2 - 7x + 3x - 21)$
$y = -4/25(x^2 - 4x - 21)$
$y = -4/25x^2 + \frac{16}{25}x + \frac{84}{25}$

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Exponential Expressions

9. Evaluate.

a) 7^0 $=1$	b) -7^0 $=-1$	c) $\left(-\frac{85}{86}\right)^0$ $=1$
d) 9^2 $=81$	e) -9^2 $=-81$	f) $(-9)^2$ $=81$
g) 9^{-2} $=\left(\frac{1}{9}\right)^2$ $=\frac{1}{81}$	h) -9^{-2} $=-\left(\frac{1}{9}\right)^2$ $=-\frac{1}{81}$	i) $(-9)^{-2}$ $=\left(\frac{1}{-9}\right)^2$ $=\frac{1}{81}$
j) $\left(\frac{3}{4}\right)^3$ $=\frac{27}{64}$	k) $\left(\frac{3}{4}\right)^{-3}$ $=\left(\frac{4}{3}\right)^3$ $=\frac{64}{27}$	l) $\left(-\frac{3}{4}\right)^{-3}$ $=\left(-\frac{4}{3}\right)^3$ $=-\frac{64}{27}$

10. Simplify. Then, evaluate.

a) $7^0 \times 7^3$ $=7^3$ $=343$	b) $2^{-5} \div 2^7$ $=2^{-5-7}$ $=2^{-12}$ $=\left(\frac{1}{2}\right)^{12}$ $=\frac{1}{4098}$	c) $\left(\frac{1}{4}\right)^{-1} \times 4$ $=4 \times 4$ $=16$
d) $(10^3)^2$ $=10^6$ $=1{,}000{,}000$	e) $2^{-3} + 2^{-2}$ $=\left(\frac{1}{2}\right)^3+\left(\frac{1}{2}\right)^2$ $=\frac{1}{8}+\frac{1}{4}$ $=\frac{1}{8}+\frac{2}{8}$ $=\frac{3}{8}$	f) $-2^{-3} - 2^{-2}$ $=-\left(\frac{1}{2}\right)^3-\left(\frac{1}{2}\right)^2$ $=-\frac{1}{8}-\frac{1}{4}$ $=-\frac{1}{8}-\frac{2}{8}$ $=-\frac{3}{8}$

g) $4^{-2} - 2^{-4} + \left(\frac{1}{2}\right)^5 - \left(\frac{2}{5}\right)^{-3} + \left(\frac{2}{6}\right)^{-1}$

$\left(\frac{1}{4}\right)^2-\left(\frac{1}{2}\right)^4+\left(\frac{1}{2}\right)^5-\left(\frac{5}{2}\right)^3+\left(\frac{6}{2}\right)^1$

$=\frac{1}{16}-\frac{1}{16}+\frac{1}{32}-\frac{125}{8}+\frac{6}{2}$

$=\frac{1}{32}-\frac{500}{32}+\frac{48}{32}$

$=-\frac{451}{32}$

Answers

1. A. Quadratic **1.B.** Quadratic **1.C.** Linear **1.D.** Quadratic **2.A.** Up **2.B.** Up **2.C.** Down **2.D.** Down **2.E.** Up **2.F.** Down **3.A.** Vertex=(1,5), Max=5 **3.B.** Vertex=(-2, -5), Min=-5 **4.A.** Zeros: x=-1 and x=2, AofS: x=0.5 **4.B.** Zeros: x=1, AofS: x=1 **4.C.** Zeros: None, AofS: x=0 **5.A.** x=-2 **5.B.** x=1.5 **5.C.** x=6.5 **6.A.** Vertex=(-0.5, -12.25) **6.B.** Vertex=(-1,1) **7.A.** AofS: x=-1, Vertex=(-1,-9), Zeros: x=2 and x=-4, Opens Up **7.B.** AofS: x=-1, Vertex=(-1,-8), Zeros: x=1 and x=-3, Opens Up **8.A.** $y = 2(x+7)(x-5), y = 2x^2 + 4x - 70$ **8.B.** $y = \frac{1}{5}(x+2)(x-8), y = \frac{1}{5}x^2 - \frac{6}{5}x - \frac{16}{5}$ **8.C.** $y = \frac{3}{4}(x+6)(x-2), y = \frac{3}{4}x^2 + 3x - 9$ **8.D.** $y = \frac{-4}{25}(x+3)(x-7), y = \frac{-4}{25}x^2 + \frac{16}{25}x + \frac{84}{25}$ **9.A.** 1 **9.B.** -1 **9.C.** 1 **9.D.** 81 **9.E.** -81 **9.F.** 81 **9.G.** 1/81 **9.H.** -1/81 **9.I.** 1/81 **9.J.** 27/64 **9.K.** 64/27 **9.L.** -64/27 **10.A.** 343 **10.B.** 1/4098 **10.C.**16 **10.D.** 1000000 **10.E.** 3/8 **10.F.** -3/8 **10.G.** -451/32