Accelerated Geometry

Module 3 Test Review

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Determine the x AND y intercepts of the following functions:

1) $f(x) = \frac{1}{3}(x-3)^2 - 7$

x-int

$1/3(x-3)^2 - 7 = 0$

$1/3(x-3)^2 = 7$

$(x-3)^2 = 21$

$x-3 = \pm\sqrt{21}$

$x = 3 \pm \sqrt{21}$

$\boxed{(3 \pm \sqrt{21}, 0)}$

y-int

$y = \frac{1}{3}(0-3)^2 - 7$

$= 1/3(9) - 7$

$= 3 - 7$

$= -4$

$\boxed{(0, -4)}$

2) $f(x) = -8x^2 + x - 5$

x-int

$-8x^2 + x - 5 = 0$

$x = \frac{-1 \pm \sqrt{1 - 4(-8)(-5)}}{2(-8)}$

$= \frac{-1 \pm \sqrt{-159}}{-16}$

$= \boxed{\left(\frac{1 \pm i\sqrt{159}}{16}, 0\right)}$

NO real x-int.

y-int

$y = -8(0)^2 + (0) - 5$

$y = -5$

$\boxed{(0, -5)}$

3) $f(x) = -(x+8)^2 + 1$

x-int

$-(x+8)^2 + 1 = 0$

$-(x+8)^2 = -1$

$(x+8)^2 = 1$

$x + 8 = \pm 1$

$x = -7, -9$

$\boxed{(-7, 0) \,\&\, (-9, 0)}$

y-int

$y = -(0+8)^2 + 1$

$= -64 + 1$

$= -63$

$\boxed{(0, -63)}$

4) $f(x) = x^2 - 2x - 15$

x-int

$x^2 - 2x - 15 = 0$

$(x-5)(x+3) = 0$

$x = 5, -3$

$\boxed{(5, 0) \,\&\, (-3, 0)}$

y-int

$y = 0^2 - 2(0) - 15$

$= -15$

$\boxed{(0, -15)}$

Determine whether the given functions have a maximum or minimum value and where that value lies:

5) $f(x) = 4x^2 - 16x + 5$

$x = \frac{16}{2(4)} = \frac{16}{8} = 2$

V: $(2, -11)$

$\boxed{\text{min @ } y = -11}$

6) $f(x) = -(4x)^2$

V: $(0, 0)$

$\boxed{\text{max @ } y = 0}$

Determine the vertex and end behavior of the given functions:

7) $f(x) = -\frac{2}{5}(x+4)^2 + 6$

$\boxed{V: (-4, 6)}$

EB: As $x \to -\infty, f(x) \to -\infty$

As $x \to \infty, f(x) \to -\infty$

8) $f(x) = 5x^2 + x + 8$

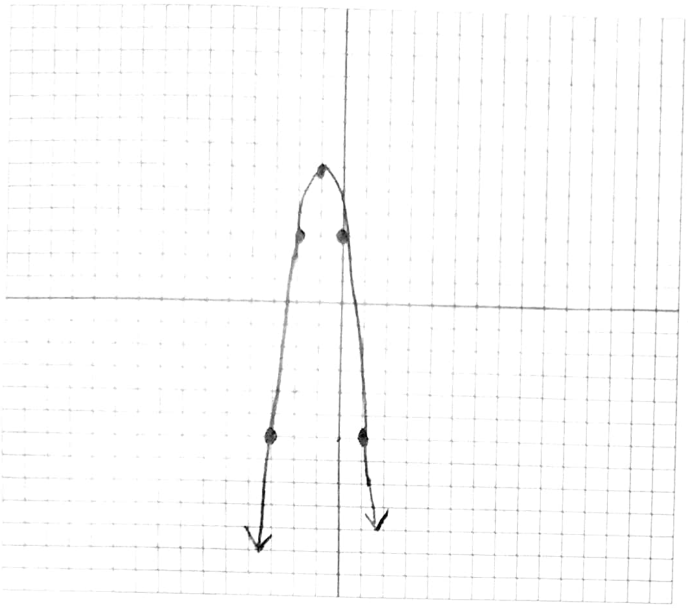
$x = \frac{-1}{2(5)} = \frac{-1}{10}$

$\boxed{V: \left(\frac{-1}{10}, \frac{159}{20}\right)}$

EB: As $x \to -\infty, f(x) \to \infty$

As $x \to \infty, f(x) \to \infty$

9)



$f(x) = -3(x+1)^2 + 6$

X-1	-3y+6
-3	-6
-2	3
-1	6
0	3
1	-6

$-3(x+1)^2 + 6 = 0$

$-3(x+1)^2 = -6$

$(x+1)^2 = 2$

$x+1 = \pm\sqrt{2}$

a) down

b) V: $(-1, 6)$

c) AOS: $X = -1$

d) D: $\mathbb{R}$

e) R: $y \leq 6$

f) x-int: $(-1 \pm \sqrt{2}, 0)$

g) y-int: $(0, 3)$

h) max @ $y = 6$

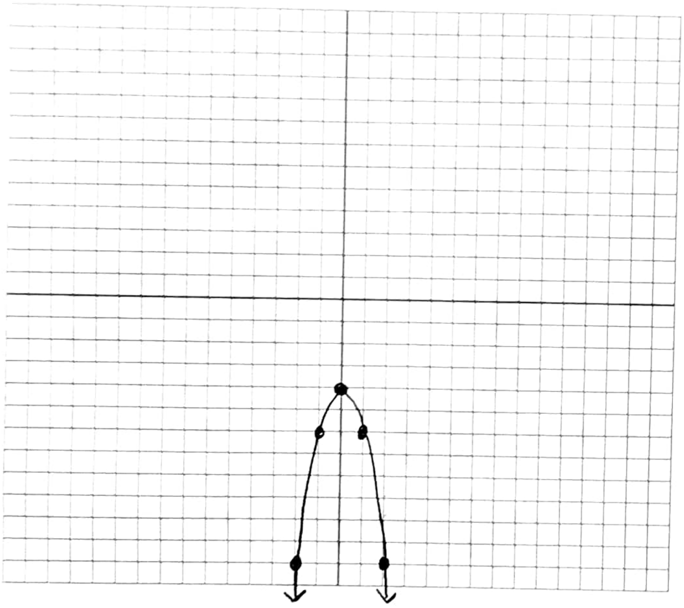
i) Inc: $(-\infty, -1)$

Dec: $(-1, \infty)$

j) As $X \to -\infty, f(X) \to -\infty$

As $X \to \infty, f(X) \to \infty$

10)



$f(x) = -2x^2 - 4$

x	-2y-4
-2	-12
-1	-6
0	-4
1	-6
2	-12

$-2x^2 - 4 = 0$

$-2x^2 = 4$

$x^2 = -2$

$x = \pm i\sqrt{2}$

a) down

b) V: $(0, -4)$

c) AOS: $X = 0$

d) D: $\mathbb{R}$

e) R: $y \leq -4$

f) x-int: No real x-int.

$(\pm i\sqrt{2}, 0)$

g) y-int: $(0, -4)$

h) max @ $y = -4$

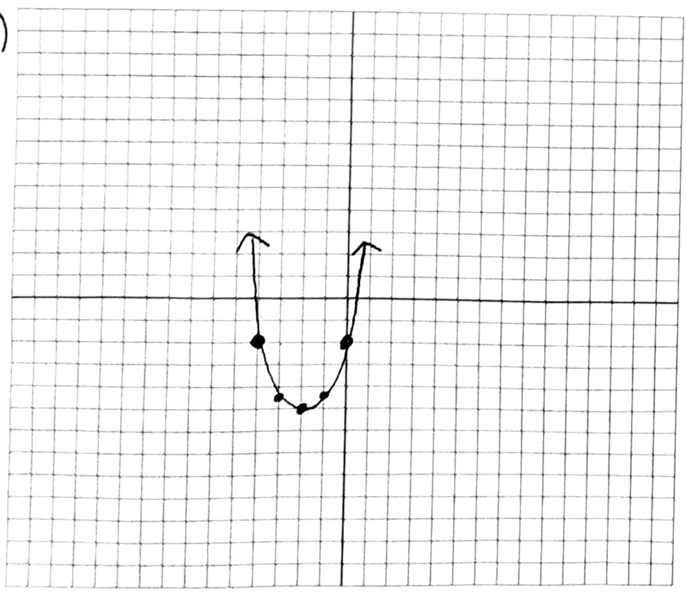
i) Inc: $(-\infty, 0)$

Dec: $(0, \infty)$

j) As $X \to -\infty, f(X) \to -\infty$

As $X \to \infty, f(X) \to -\infty$.

11)



$f(X) = 3/4(x+2)^2 - 5$

X-2	3/4y-5
-4	-2
-3	-4.25
-2	-5
-1	-4.25
0	-2

$3/4(x+2)^2 - 5 = 0$

$3/4(x+2)^2 = 5$

$(x+2)^2 = 20/3$

$x+2 = \pm \frac{2\sqrt{5}}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}}$

$x+2 = \pm \frac{2\sqrt{15}}{3}$

$x = -2 \pm \frac{2\sqrt{15}}{3}$

a) up

b) V: $(-2, -5)$

c) AOS: $X = -2$

d) D: $\mathbb{R}$

e) R: $y \geq -5$

f) x-int: $\left(-2 \pm \frac{2\sqrt{15}}{3}, 0\right)$

g) y-int: $(0, -2)$

h) min @ $y = -5$

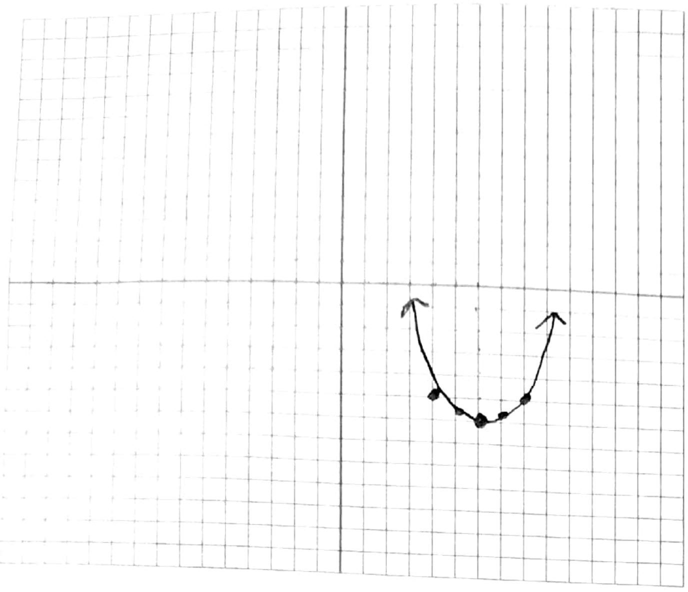
i) Inc: $(-2, \infty)$

Dec: $(-\infty, -2)$

j) As $X \to -\infty, f(X) \to \infty$

As $X \to \infty, f(X) \to \infty$

12)



$f(x) = \frac{1}{4}x^2 - 3x + 3$

$x = \frac{3}{2(1/4)} = \frac{3}{1/2} = 6$

x	y
4	-5
5	-5.75
6	-6
7	-5.75
8	-5

$x = \frac{+3 \pm \sqrt{9 - 4(1/4)(3)}}{2(1/4)}$

$= \frac{3 \pm \sqrt{6}}{1/2} = 6 \pm 2\sqrt{6}$

a) up

b) V: $(6, -6)$

c) AOS: $x = 6$

d) D: $\mathbb{R}$

e) R: $y \geq -6$

f) x-int: $(6 \pm 2\sqrt{6}, 0)$

g) y-int: $(0, 3)$

h) min @ $y = -6$

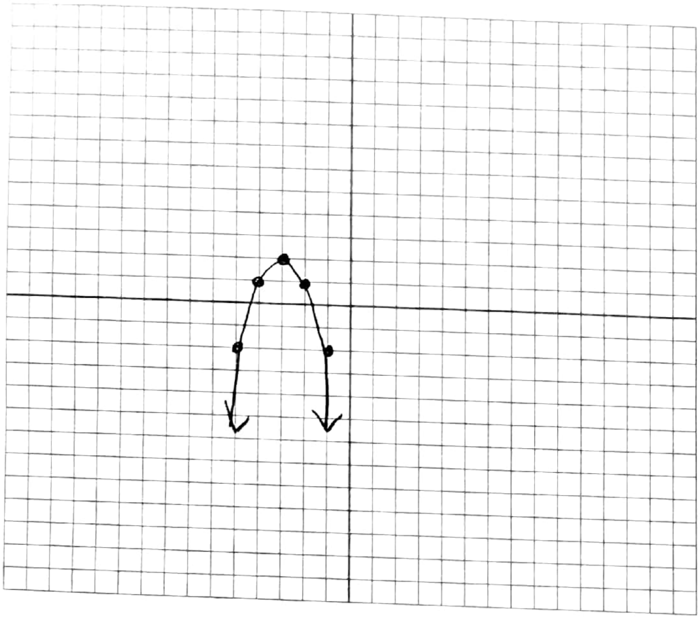
i) Inc: $(6, \infty)$

Dec: $(-\infty, 6)$

j) As $x \to -\infty, f(x) \to \infty$

As $x \to \infty, f(x) \to \infty$

13)



$f(x) = -x^2 - 6x - 7$

$x = \frac{6}{2(-1)} = -3$

x	y
-5	-2
-4	1
-3	2
-2	1
-1	-2

$x = \frac{6 \pm \sqrt{36 - 4(-1)(-7)}}{2(-1)}$

$= \frac{6 \pm \sqrt{8}}{-2} = \frac{6 \pm 2\sqrt{2}}{-2}$

$= -3 \pm \sqrt{2}$

a) down

b) V: $(-3, 2)$

c) AOS: $x = -3$

d) D: $\mathbb{R}$

e) R: $y \leq 2$

f) x-int: $(-3 \pm \sqrt{2}, 0)$

g) y-int: $(0, -7)$

h) max @ $y = 2$

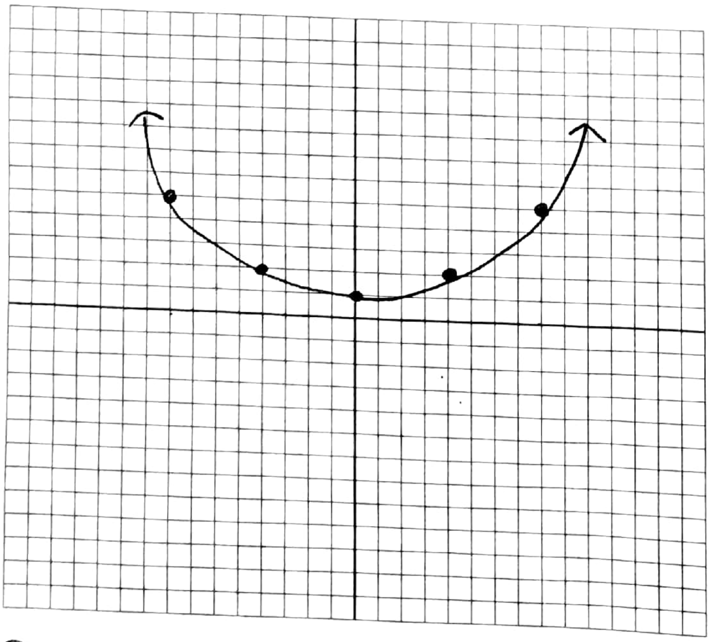
i) Inc: $(-\infty, -3)$

Dec: $(-3, \infty)$

j) As $x \to -\infty, f(x) \to -\infty$

As $x \to \infty, f(x) \to -\infty$

14)



$f(x) = (1/4x)^2 + 1$

4x	y+1
-8	5
-4	2
0	1
4	2
8	5

$(1/4x)^2 + 1 = 0$

$\sqrt{(1/4x)^2} = \sqrt{-1}$

$1/4x = \pm i$

$x = \pm 4i$

a) up

b) V: $(0, 1)$

c) AOS: $x = 0$

d) D: $\mathbb{R}$

e) R: $y \geq 1$

f) x-int: No real x-int

$(\pm 4i, 0)$

g) y-int: $(0, 1)$

h) min @ $y = 1$

i) Inc: $(0, \infty)$

Dec: $(-\infty, 0)$

j) As $x \to -\infty, f(x) \to \infty$

As $x \to \infty, f(x) \to \infty$

Graph each of the following functions and list the characteristics: (Separate paper)

a) direction	**b) vertex**	**c) AOS**	**d) domain**	**e) range**
f) X-intercepts	**G) Y-intercept**	**h) Max/Min? Where?**	**I) Int of Inc/Dec**	**j) end behavio**

9) $f(x) = -3(x+1)^2 + 6$

10) $f(x) = -2x^2 - 4$

11) $f(x) = \frac{3}{4}(x+2)^2 - 5$

12) $f(x) = \frac{1}{4}x^2 - 3x + 3$

13) $f(x) = -x^2 - 6x - 7$

14) $f(x) = (\frac{1}{4}x)^2 + 1$

List the transformations for the following functions.

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

- reflection across x-axis
- h. stretch by 6
- up 4

16) $f(x) = 8(x+5)^2 - 1$

- v. stretch by 8
- left 5
- down 1

Determine the transformations from the parent graph of $y = x^2$:

17) $f(x) = -2x^2 + 8x - 7$

$-8 + y + 7 = -2(x^2 - 4x + \underline{4})$

$y - 1 = -2(x-2)^2$

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

- reflect over x-axis
- v. stretch by 2
- right 2
- up 1

18) $f(x) = \frac{1}{3}x^2 + x + 4$

$\frac{3}{4} + y - 4 = 1/3\,(x^2 + 3x + \underline{9/4})$

$y - \frac{13}{4} = 1/3\,(x + 3/2)^2$

$y = 1/3\,(x + 3/2)^2 + 13/4$

- v. shrink by 1/3
- left 3/2
- up 13/4

27) A model rocket is launched from the roof of a building. Its flight path is modeled by $h(t) - 5t^2 + 30t + 10$ where h is the height of the rocket above the ground in meters and t is the time after the launch in seconds. What is the rocket's maximum height?

← max height at vertex

$x = \frac{-30}{2(-5)} = 3$

$(3, 55)$

$\boxed{\text{The rocket's max. height is 55 meters.}}$

28) If $f(x) = -(x+9)^2 - 7$ is shifted up 4 and right 2 and $g(x) = -3x^2 - 6x$ is shifted left 5 and down 7,

V: $(-9, -7)$

NV: $(-7, -3)$

$\frac{+6}{2(-3)} = -1$

V: $(-1, 3)$

NV: $(-6, -4)$

a) Which function has a higher maximum?

f(x) has a higher maximum at $y = -3$.

b) Which function's interval of decrease starts further right?

g(x) starts decreasing further to the right.

29) Use the average rate of change to determine over which interval is the function the steepest. $f(x) = -x^2 - 7x + 3$

a) $[-9, -7]$

$(-9, -15)(-7, 3)$

$\frac{3 - -15}{-7 - -9} = \frac{18}{2} = 9$

b) $[-7, -4]$

$(-7, 3)\ (-4, 15)$

$\frac{15 - 3}{-4 - -7} = \frac{12}{3} = 4$

c. $[-1, 1]$

$(-1, 9)\ (1, -5)$

$\frac{-5 - 9}{1 - -1} = \frac{-14}{2} = -7$

*The function is steepest over the interval $[-9, -7]$

30) Given the function $f(x) = 3x^2 - 24x + 43$, convert to vertex form, then identify the range, interval of increase and interval of decrease.

$48 + y - 43 = 3(x^2 - 8x + 16)$

$y + 5 = 3(x-4)^2$

$\boxed{y = 3(x-4)^2 - 5}$

R: $y \geq -5$

Inc: $(4, \infty)$

Dec: $(-\infty, 4)$

Rewrite the following into standard form:

19) $f(x) = \frac{2}{5}(x-5)^2 + 2$

$y = 2/5(x^2 - 10x + 25) + 2$

$y = 2/5\, x^2 - 4x + 10 + 2$

$\boxed{y = 2/5\, x^2 - 4x + 12}$

20) $f(x) = -(x+6)^2 + 11$

$y = -(x^2 + 12x + 36) + 11$

$y = -x^2 - 12x - 36 + 11$

$\boxed{y = -x^2 - 12x - 25}$

Write a quadratic function with the following transformations of the parent graph $f(x) = x^2$.

21) A horizontal stretch of 6, shift up 8, and a reflection over the y-axis

$y = (-1/6\, x)^2 + 8$

22) Vertical shrink by 1/4, shift right 3, shift down 1

$y = 1/4\,(x-3)^2 - 1$

23) Reflection over the x-axis, a horizontal shrink of 3/4,

$y = -(4/3\, x)^2$

Determine the Domain, Range, and Intervals of Increase/Decrease of the functions:

24) Use your answer to #20 $y = -x^2 - 12x - 25$

D: $\mathbb{R}$

R: $y \leq 11$

Inc: $(-\infty, -6)$

Dec: $(-6, \infty)$

$x = \frac{12}{2(-1)} = -6$

V: $(-6, 11)$

25) Use your answer to #22

$y = 1/4\,(x-3)^2 - 1$

V: $(3, -1)$

D: $\mathbb{R}$

R: $y \geq -1$

Inc: $(3, \infty)$

Dec: $(-\infty, 3)$

26) A dolphin jumps out of the water. The path the dolphin travels is modeled by $h = -0.2d^2 + 2d$ where h represents the height of the dolphin and d represents horizontal distance. in ft

max height at vertex

- What is the maximum height the dolphin reaches?

$x = \frac{-2}{2(-.2)} = 5$ V: $(5, 5)$

The max height the dolphin reaches is 5 ft.

- How far did the dolphin jump?

$-.2d^2 + 2d = 0$

$-d(.2d - 2) = 0$

$.2d - 2 = 0$

$.2d = 2$

$d = 10$

The dolphin jumped 10 ft.