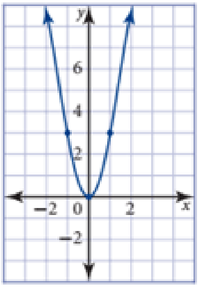
Relations: Cycle 4 Review

For each parabola: a) identify if 'a' is positive or negative
b) state the maximum value and when it occurs
or min.

a)

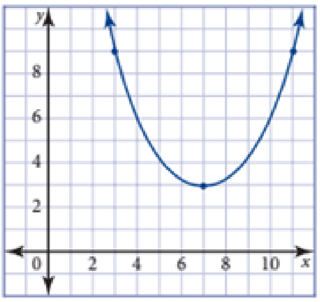


'a' is positive

Max/min value is 0

and occurs when x = 0

b)

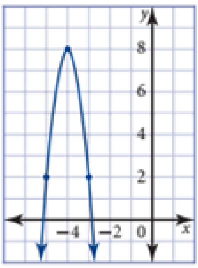


'a' is positive

Max/min value is 3

and occurs when x = 7

c)

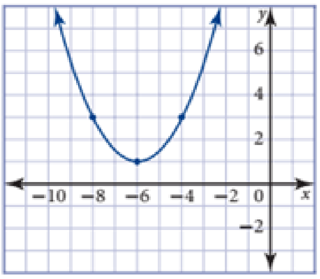


'a' is negative

Max/min value is 8

and occurs when x = −4

d)



'a' is positive

Max/min value is 1

and occurs when x = -6

2. For each parabola:
   i) identify if it opens up or down
   ii) identify if there is a vertical stretch or a vertical compression
   iii) state the maximum/minimum value and when it occurs

a) $y = 4(x-6)^2 + 10$ **b)** $y = -0.25(x+4)^2 - 2$
c) $y = 0.8(x+1)^2 + 9$ **d)** $y = -2.5(x-9)^2 - 5$
e) $y = 0.2(x-3)^2 - 7$ **f)** $y = 5(x+7)^2 + 3$
g) $y = 6(x+2)^2 - 1$ **h)** $y = -0.5(x-10)^2 + 6$

opens down ($a = -ve$)
vertical compression ($0.5 < 1$)
max value is 6 and occurs when $x = 10$

a) $y = 4(x-6)^2 + 10$
i) opens up ("a" is positive)
ii) vertical stretch ($a > 1$)
iii) the min. value is 10 and occurs when $x = 6$.

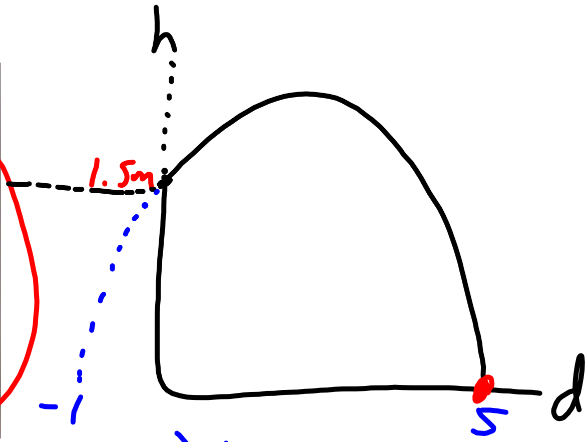
Textbook review questions: p. 226 #2, 9, 12; p. 228 # 11
p. 286 #5, 12, 15; p. 288 #11, 12
p. 414 #7, 8, 11

p.287

15. A rider on a mountain bike jumps off a ledge. Her path is modelled by the relation $h = -0.3d^2 + 1.2d + 1.5$, where h is her height above the ground and d is her horizontal distance from the ledge, both in metres.

a) What is the height of the ledge?

b) How far was the rider from the ledge when she landed?



a) $d = 0$

$h = -0.3(0)^2 + 1.2(0) + 1.5$
$= 0 + 0 + 1.5$
$= 1.5$

b) $h = 0$

$0 = A \cdot B$

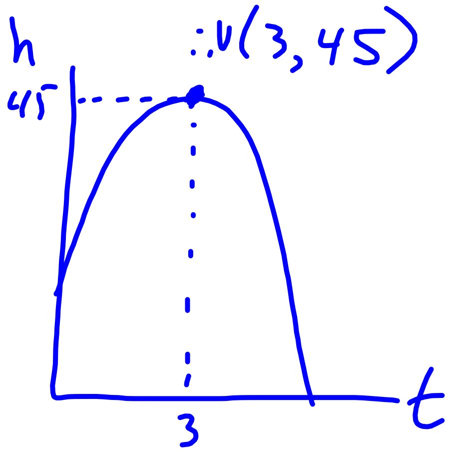
$0 = -0.3d^2 + 1.2d + 1.5$
$= -0.3(d^2 - 4d - 5)$
$= -0.3(d-5)(d+1)$

$d = 5$ or $d = -1$ inadmissible

$\therefore$ She lands 5m from the ledge.

p.286

5. A ball is kicked straight up. Its path is modelled by the relation $h = -4.9t^2 + v_0t + h_0$, where h is the ball's height in metres, h_0 is the ball's initial height, in metres, t is the time in seconds, and v_0 is the ball's initial velocity, in metres per second. The ball reaches a maximum height of 45 m after 3 s. Determine the ball's initial velocity and initial height.



$h = -4.9t^2 + v_0t + h_0$

$a = -4.9 \longrightarrow$

$\therefore h = a(t-3)^2 + 45$

$h = -4.9(t-3)^2 + 45$

$= -4.9(t-3)(t-3) + 45$

$= -4.9(t^2 - 3t - 3t + 9) + 45$

$= -4.9(t^2 - 6t + 9) + 45$

$= -4.9t^2 + 29.4t - 44.1 + 45$

$= -4.9t^2 + \underbrace{29.4t}_{v_0t} + \underbrace{0.9}_{h_0}$

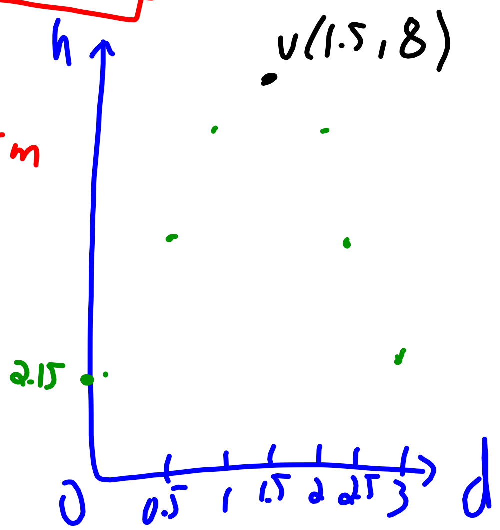
$\therefore v_0 = 29.4$ $\quad \therefore h_0 = 0.9$

p.226 #12 $h = -2.6d^2 + 7.8d + 2.15$

a)

d	h
0	2.15
0.5	5.4
1	7.35
1.5	8
2	7.35
2.5	5.4
3	2.15

b) initial height = 2.15 m (d = 0) (also y-intercept)



$\because v(1.5, 8)$

$\therefore y = a(x-1.5)^2 + 8$ is the "family"

from above $a = -2.6$

$\therefore y = -2.6(x-1.5)^2 + 8$ is the equation.