Pre-Calculus Math 11

page 175 # 6, 8, 10-12, 15

6. a) $y = x^2 + 6x + 2$

use $x = \frac{-b}{2a}$

$x = \frac{-6}{2 \cdot 1}$

$x = -3$ (x-value of vertex)

now find the y-value → $y = (-3)^2 + 6 \cdot (-3) + 2$

$y = 9 - 18 + 2$

$y = -7$

vertex: $(-3, -7)$

b) $y = 3x^2 - 12x + 5$

$x = \frac{-(-12)}{2(3)}$

$x = \frac{12}{6}$

$x = 2$

$y = 3(2)^2 - 12(2) + 5$

$y = 12 - 24 + 5$

$y = -7$

vertex: $(2, -7)$

c) $y = -x^2 + 8x - 11$

$x = \frac{-8}{2(-1)}$

$x = \frac{-8}{-2}$

$x = 4$

$y = -(4)^2 + 8(4) - 11$

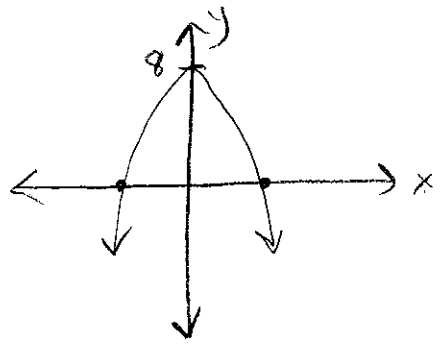
$y = -16 + 32 - 11$

$y = 5$

vertex: $(4, 5)$

8. a) axis of symmetry: $x = 0$ → the y-axis is the axis of sym.

max! value: 8 → "max" means it opens down



2 x-intercepts

1 positive

1 negative

a sketch really helps!

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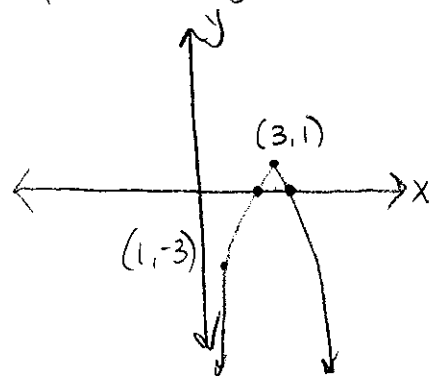
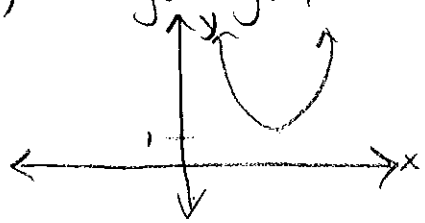
8. b) Vertex: (3, 1)
point on graph: (1, -3)



must open down because this point is below the vertex

2 x-intercepts
both positive

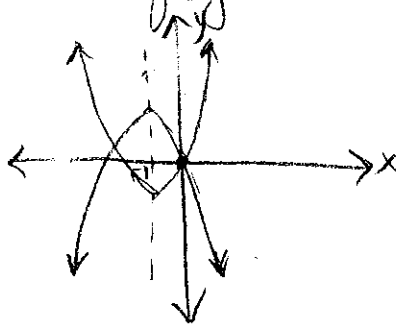
c) range: $y \geq 1$



range is greater than 1 so the parabola must open up

0 x-intercepts

d) y-intercept: 0
axis of sym: $x = -1$



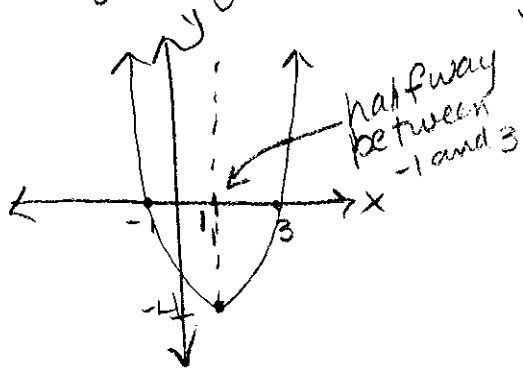
could open up or down

in both parabolas there is

2 x-intercepts
1 is 0
1 is negative

10. a) x-intercepts: -1, 3
range: $y \geq -4$

"greater" means it opens up



3 points: (-1, 0), (3, 0), (1, -4)

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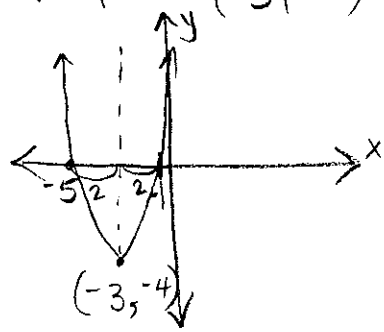
10. b) 1 x-intercept: -5
vertex: (-3, -4)

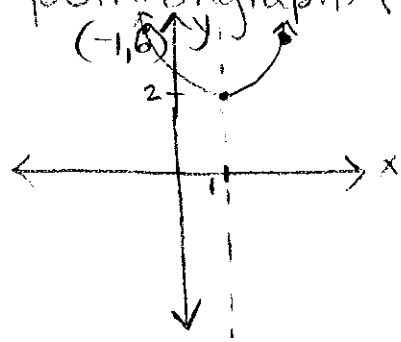


opens up because x-intercept is above vertex

use horizontal distance from -5 to -3 and symmetry to find 2nd x-intercept

3 points: (-3, -4), (-5, 0), (-1, 0)

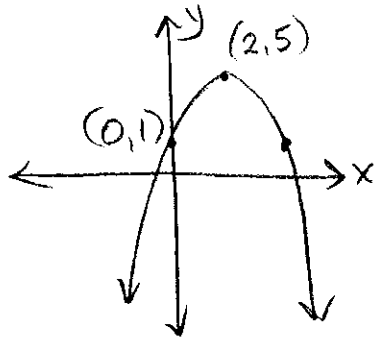
c) axis of sym: x = 1
min: 2
point on graph: (-1, 6)



- min. must be on the axis of sym
- use symmetry to find a point across from (-1, 6)
  1 - -1 = 2, 1 + 2 = 3

3 points: (-1, 6), (3, 6), (1, 2)

d) vertex: (2, 5)
y-intercept: 1



opens down because y-intercept is below the vertex

use symmetry to find second point
2 - 0 = 2 2 + 2 = 4

3 points: (2, 5), (0, 1), (4, 1)

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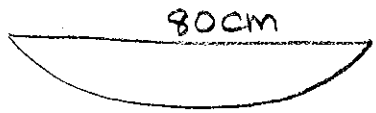
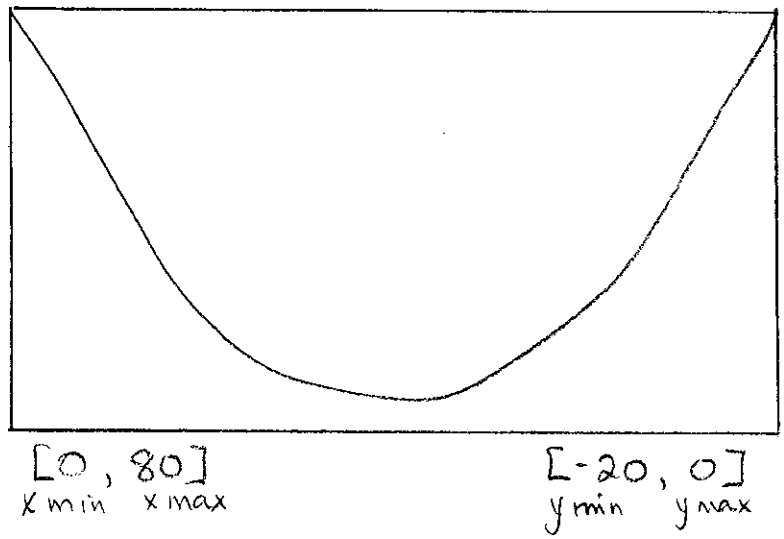
11. satellite dish



$d(x) = 0.0125x^2 - x$

a) domain: $\{x \mid 0 \leq x \leq 80, x \in R\}$

b)



$y = 0.0125x^2 - x$

c) max. depth of dish is 20cm
there is no max. for the function → it has a min. at -20

d) range: $\{y \mid -20 \leq y \leq 0, y \in R\}$

e) $d(25) = 17.19$ cm (use "2nd calc" then "value")

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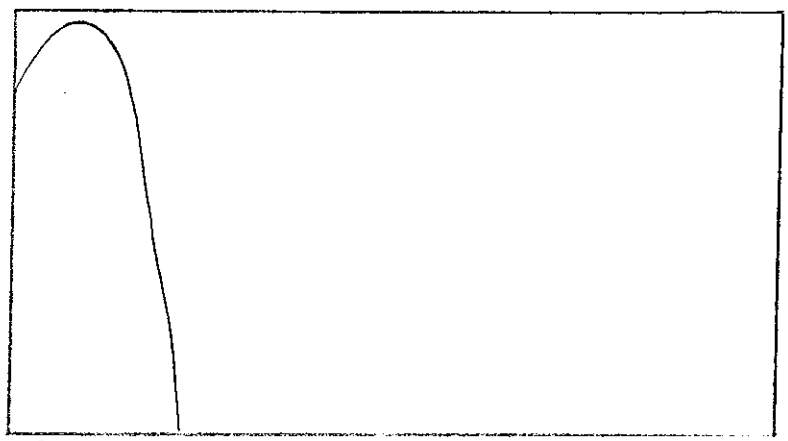
12. jumping spider
$h(t) = -490t^2 + 75t + 12$

a)



$y = -490x^2 + 75x + 12$

b) h-intercept represents the spider's height at 0 seconds so it is the height of the log

c) Find the vertex with the graphing calc:
select "2nd calc" then "maximum"
Vertex: (0.0765, 14.8699)
The spider's maximum height is 14.8699 cm and that height is reached at 0.0765 sec.

d) The spider lands on the ground when the height is 0. Find the x-intercept.
select "2nd calc" then "zero"
X-intercept: (0.2507, 0)
The spider lands on the ground after 0.2507 sec

e) domain: $\{x \mid 0 \le x \le 0.2507, x \in R\}$

range: $\{y \mid 0 \le y \le 14.8699\}$

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12. f) To find the height at 0.05 sec either

① put 0.05 into the formula and simplify

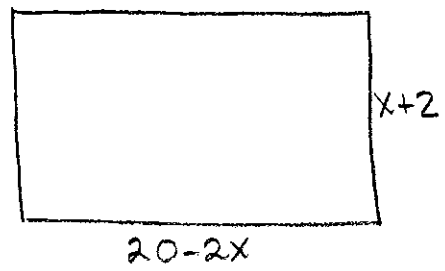
$h(0.05) = -490(0.05)^2 + 75(0.05) + 12$

$h(0.05) = -1.225 + 3.75 + 12$

$h(0.05) = 14.525$ m OR

② use "2nd, calc" then "value" and put $x = 0.05$ which gives 14.525 m

15. a)



Area $= (x+2)(20-2x)$

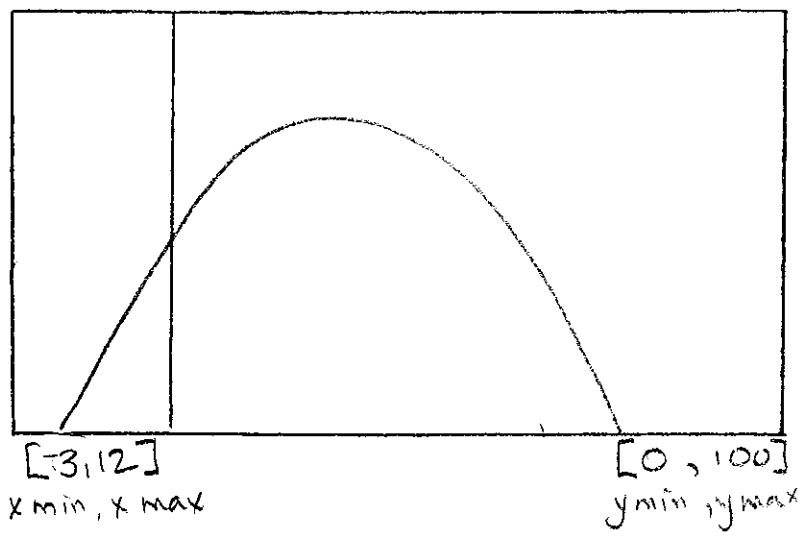
Area $= 20x - 2x^2 + 40 - 4x$

Area $= -2x^2 + 16x + 40$

so...

$f(x) = -2x^2 + 16x + 40$

b)



$y = -2x^2 + 16x + 40$

c) The x-intercepts represent when one side of the rectangle when the area is zero. If the area is zero then the one side has no length. The values between the x-intercepts represents values that will produce an actual rectangle with 4 sides.

d) The vertex (4.0, 72) represents the maximum area, 72, that occurs when $x = 4$.

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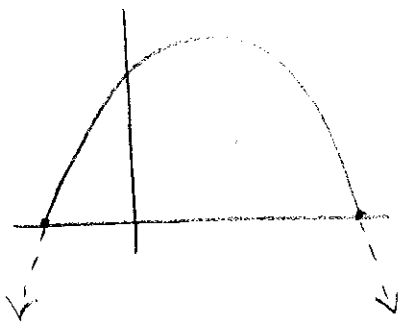
15. e) domain: $\{x \mid -2 \leq x \leq 10, x \in R\}$

range: $\{y \mid 0 \leq y \leq 72, y \in R\}$

f) It has a maximum of 72 and a minimum of 0.

g) No minimum if you consider the whole of the x-axis as the domain.



because the area can't be less than zero we consider only the solid part of the parabola and there is a minimum to this graph.

If we consider the whole parabola that has values below the x-axis, there is no minimum.