[#2] Fred has 48 m of fence to rope off a rectangular swimming area against the sea wall. He need only rope three sides of the rectangular area. Determine the maximum area he can enclose?

[#3] A team charges $20 for a ticket. Usually they sell 120 tickets per game. They owners determined that for every $5 they raise the price, they'll sell 10 fewer tickets.

(a) Determine the maximum revenue.

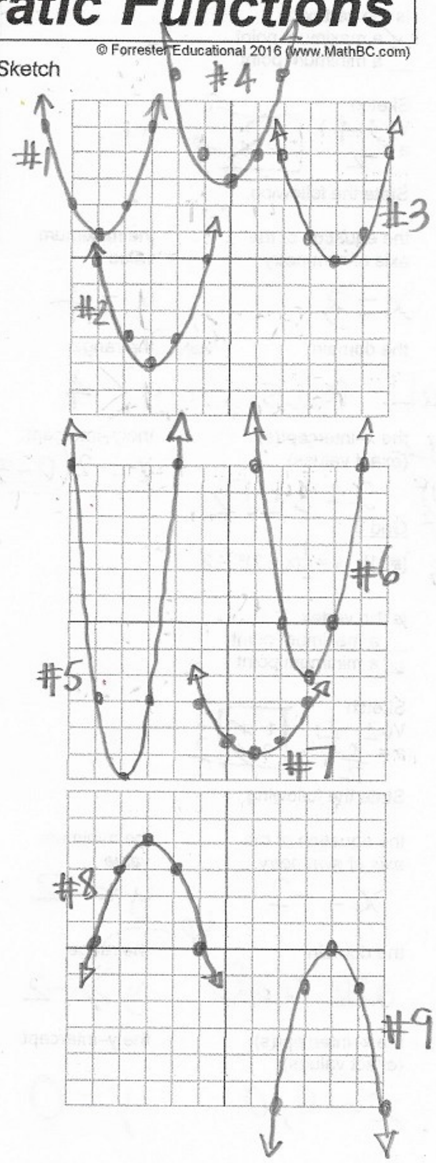
(b) What ticket price will maximise revenue?

(c) If revenue is maximised, how many tickets will be sold?

1

Math 11 • Quadratic Functions

Sketch



Grid 1

[#1] $y = (x + 5)^2 + 1$

V(-5, 1)

1	1
2	4

[#2] $y = (x + 3)^2 - 4$

V(-3, -4)

1	1
2	4

[#3] $y = (x - 4)^2$

V(4, 0)

1	1
2	4

[#4] $y = x^2 + 3$

V(0, 3)

1	1
2	4

Grid 2

[#5] $y = 3(x + 4)^2 - 6$

V(-4, -6)
a = 3

1	1	3
2	4	12

[#6] $y = 2(x - 3)^2 - 2$

V(3, -2)
a = 2

1	1	2
2	4	8

[#7] $y = \frac{1}{2}(x - 1)^2 - 5$

V(1, -5)
a = $\frac{1}{2}$

1	1	$\frac{1}{2}$
2	4	2

Grid 3

[#8] $y = -(x + 3)^2 + 4$

V(-3, 4)
a = -1

1	1	-1
2	4	-4

[#9] $y = -\frac{3}{2}(x - 4)^2$

V(4, 0)
a = $-\frac{3}{2}$

1	1	$-\frac{3}{2}$
2	4	-6

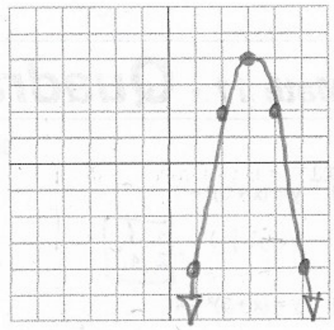
Grid 4

[#10] $y = -2(x-3)^2 + 4$

Is the vertex ...

✓ a maximum point

__ a minimum point



Sketch

V(3 , 4)

a = −2

1	1 → −2
2	4 → −8

State the following..

the equation of the axis of symmetry

$x = 3$

the maximum value

$y = 4$

the domain

all reals

the range (down)

$y \leq 4$

the x–intercept(s) (exact values)

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

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

$2 = (x-3)^2$

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

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

the y–intercept.

$y = -2(0-3)^2 + 4 = -14$

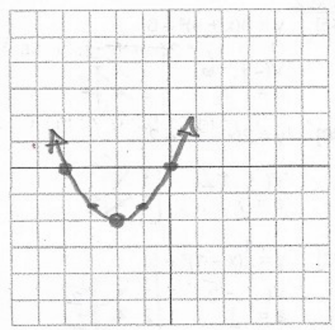
Grid 5

[#11] $y = \frac{1}{2}(x + 2)^2 - 2$

Is the vertex ...

__ a maximum point

✓ a minimum point



Sketch

V(−2 , −2)

a = $\frac{1}{2}$

1	1 → $\frac{1}{2}$
2	4 → 2

State the following..

the equation of the axis of symmetry

$x = -2$

the minimum value

$y = -2$

the domain

all reals

the range (up)

$y \geq -2$

the x–intercept(s) (exact values)

$x = -4, 0$

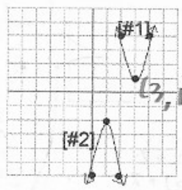
the y–intercept.

$y = 0$

2

Math 11 • Quadratic Functions

Write the equations



[#1] $y = 3(x-3)^2 + 1$

over 1, up 3

[#2] $y = 4(x-1)^2 - 2$

[#3] A parabola has vertex (5, –3) and passes through (9, –7).

V (5, –3), P (9, –7)

$y = a(x-5)^2 - 3$

$-7 = a(9-5)^2 - 3$

$-7 = 16a - 3$

$-4 = 16a$

$-\frac{1}{4} = a$

$y = -\frac{1}{4}(x-5)^2 - 3$

[#4] A quadratic function has minimum point (2, –3) and y–intercept 9.

V(2, –3)

P(0, 9)

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

$9 = a(0-2)^2 - 3$

$9 = 4a - 3$

$12 = 4a$

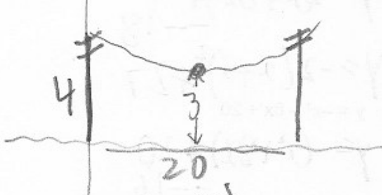
$3 = a$

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

[#5] A quadratic function has maximum point (–4, 3) and is congruent to $y = \frac{3}{4}x^2 + 17$

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

[#6] Telephone poles are 4 m high and 20 m apart. Cable is connected to the top of each pole and hangs down parabolically between the poles. If the cable's minimum height is 3 m, how high is the cable 4 m from each pole?



V(10, 3)

P(0, 4)

$y = a(x-10)^2 + 3$

$4 = a(0-10)^2 + 3$

$4 = 100a + 3$

$1 = 100a$

$\frac{1}{100} = a$

$y = \frac{1}{100}(x-10)^2 + 3$

$y = \frac{1}{100}(4-10)^2 + 3$

$y = 3.36$

3.36m

3

HALF

Math 11 • Quadratic Functions

Write in graphing form

$y = x^2 - 10x + 27$
-25
$y = (x - 5)^2 + 2$

SQUARE SUBTRACT

$y = 6x^2 + 24x + 25$
$y = 6(x^2 + 4x) + 25$
-24
$y = 6(x + 2)^2 + 1$

$24 \div 6$
$4 \times \frac{1}{2}$
2^2
$6 \cdot 4$
$25 - 24$

[#1] $y = x^2 + 6x + 5$
-9
$y = (x + 3)^2 - 4$

[#2] $y = x^2 - 8x + 3$
-16
$y = (x - 4)^2 - 13$

[#3] $y = x^2 + 10x - 1$
-25
$y = (x + 5)^2 - 26$

[#4] $y = x^2 - 6x + 9$
-9
$y = (x - 3)^2$

[#5] $y = x^2 + 8x + 16$
-16
$y = (x + 4)^2 - 16$

[#6] $y = x^2 - 3x + \frac{9}{4}$
$y = (x - \frac{3}{2})^2 - \frac{9}{4}$

[#7] $y = 3x^2 - 12x + 7$
$y = 3(x^2 - 4x) + 7$
-12
$y = 3(x - 2)^2 - 5$

[#8] $y = 5x^2 + 30x + 100$
$y = 5(x^2 + 6x) + 100$
-45
$y = 5(x + 3)^2 + 55$

[#9] $y = 2x^2 - 12x - 8$
$y = 2(x^2 - 6x) - 8$
-18
$y = 2(x - 3)^2 - 26$

[#10] $y = -3x^2 + 12x - 5$
$y = -3(x^2 - 4x) - 5$
$- -12$
$y = -3(x - 2)^2 + 7$

V(2, 7)

[#11] $y = -2x^2 - 12x + 9$
$y = -2(x^2 + 6x) + 9$
$- -18$
$y = -2(x + 3)^2 + 27$

[#12] $y = -x^2 - 8x + 20$
$y = -(x^2 + 8x) + 20$
$- -16$
$y = -(x + 4)^2 + 36$

[#13] $y = 4x^2 + 32x$

$y = 4(x^2 + 8x) + 0$
-64

$y = 4(x+4)^2 - 64$

[#14] $y = -\frac{1}{3}x^2 - 2x - 1$

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

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

[#15] $y = -4.9x^2 + 11.76x + 1.6$

$y = -4.9(x^2 - 2.4x) + 1.6$
$- -7.056$

$y = -4.9(x-1.2)^2 + 8.656$

[#17] $y = 4x^2 + 2x - 1$

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

$y = 4(x + \frac{1}{4})^2 - \frac{5}{4}$

[#18] $y = \frac{3}{4}x^2 + 2$

it is in graphing form

4

Math 11 • QuadraticFunctions

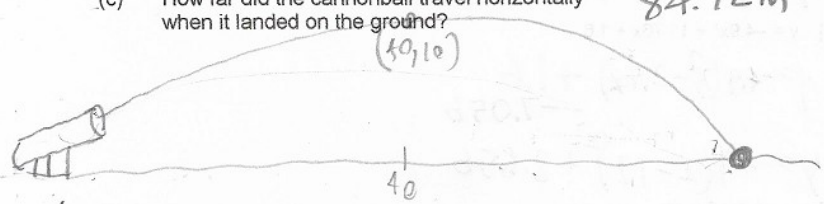
MAXIMUM MINIMUM PROBLEMS

[#1 A cannonball is fired into the air. Its height, h in m, is expressed as a function of its horizontal distance from the cannon, x in m.
$h = -0.005x^2 + 0.4x + 2$

(a) Determine the cannonball's maximum height. 10 m

(b) How far did the cannonball travel horizontally when it was at its maximum height? 40 m

(c) How far did the cannonball travel horizontally when it landed on the ground? 84.72 m



$h = -.005x^2 + 4x + 2$

$h = -.005(x^2 - 80x) + 2 - -8$

$h = -.005(x - 40)^2 + 10$

$V(40, 10)$ — 40 ↑ x, 10 ↑ h

$0 = -.005(x - 40)^2 + 10$

$-10 = -.005(x - 40)^2$

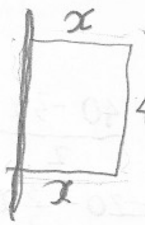
$2000 = (x - 40)^2$

$\pm\sqrt{2000} = x - 40$

$40 \pm \sqrt{2000} = x$

$x = -4.72, 84.72$ m

[#2] Fred has 48 m of fence to rope off a rectangular swimming area against the sea wall. He need only rope three sides of the rectangular area. Determine the maximum area he can enclose? $288\ m^2$



$A = lw$

$A = x(48-2x)$

$A = 48x - 2x^2$

$A = -2x^2 + 48x$

$A = -2(x^2 - 24x) + 0$
$\quad - -288$

$A = -2(x-12)^2 + 288$

$V(12, 288)$ ($12 \uparrow x$, $288 \uparrow A$)

[#3] A team charges $20 for a ticket. Usually they sell 120 tickets per game. They owners determined that for every $5 they raise the price, they'll sell 10 fewer tickets.

INITIAL

(a) Determine the maximum revenue. ± change 5$

(b) What ticket price will maximise revenue?

(c) if rev. is maximised, how many tickets will they sell?

REVENUE = PRICE PER ITEM · NUMBER OF ITEMS

$R = (20 + 5x)(120 - 10x)$

$R = 2400 - 200x + 600x - 50x^2$

$R = -50x^2 + 400x + 2400$

$R = -50(x^2 - 8x) + 2400$
$\quad - -800$

$R = -50(x-4)^2 + 3200$

$V(4, 3200)$ ($4 \uparrow x$, $3200 \uparrow R$)

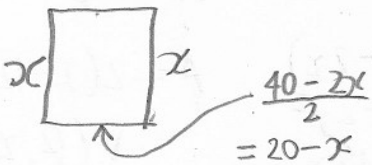
(a) $3200

(b) 20+5(4)
$40

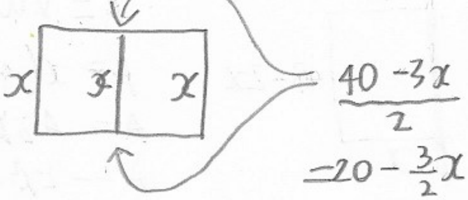
(c) 120-10(4)
80

start with a 40m Fence

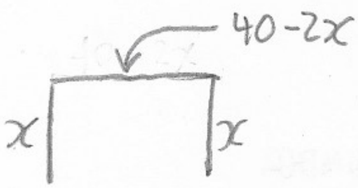
four sided rectangle



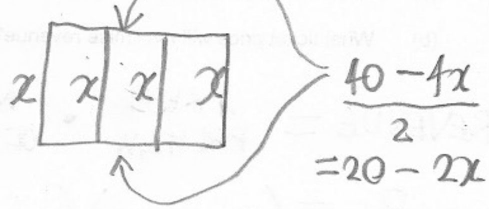
four sided rectangle with dividing wall



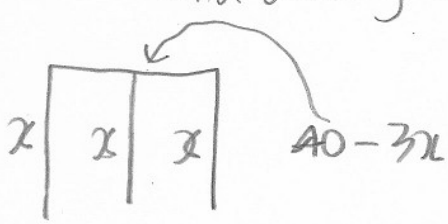
three sided rectangle



four sided rectangle with two dividing walls



three sided rectangle with dividing wall



$\frac{\text{TOTAL FENCE} - \text{the x's YOU'VE USED}}{\text{SIDES REMAINING}}$