PRACTICE 3.6 – Solving Quadratic Inequalities

* Full, worked solutions can be found in the folder linked on the Course Website ☺

Exercise 3W

Completed during the video lesson.

1 Solve each inequality:

a $3x^2 + 5x - 2 \geq 0$ **b** $x^2 - 5 \leq 0$

c $2x^2 + 6x - 6 < x^2 + 2x$

2 Solve each inequality graphically using your GDC.

a $x^2 - 12x \geq 3$ **b** $3x^2 < 7x + 6$

c $8x^2 - 3x < 9$

3 For each equation, find the value(s) of k such that the equation has two distinct real roots.

a $-x^2 + kx - 4 = 0$ **b** $x^2 + 2kx + 3 = 0$

4 Find the value(s) of m such that the equation $x^2 + 6mx + m = 0$ has no real roots.

5 Find the value(s) of k for which the quadratic equation $kx^2 - 6kx + 2 + k = 0$ has two distinct real roots.

6 The graph of $f(x) = 3x^2 + px + 4$ has no x-intercepts.

a Find an expression for the discriminant of $f(x) = 0$ in terms of p.

b Find the possible values of p.

c Let m be the largest possible integer value of p. Write down the value of m.

d The function $h(x) = 3x^2 + mx + 4$ can be written in the form $h(x) = a(x - h)^2 + k$. Find the values of a, h and k.

Completed during the video lesson.

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PRACTICE 3.7 – Applied Quadratics

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Exercise 3X

1 The length of the base of a triangle is four more than twice the height. The area of the triangle is 24 m^2. Find the lengths of the base and height of the triangle.

2 The height of a ball t seconds after it is thrown is modelled by the function $h(t) = 2 + 20t - 4.9t^2$, where h is the height of the ball in metres.

a Find the height of the ball 3 seconds after it is thrown.

b Find the times at which the ball has a height of 6 m.

c Find the maximum height of the ball.

Completed during the lesson.

TOK

How accurate is a visual representation of a mathematical concept?

3 A bus transports people from an airport to a city centre. It transports 800 people a day at a cost of €5.50 per person. Research has shown that for every decrease of €0.05 in the fare, 10 more people will ride the bus.

Suppose there have been x decreases of €0.05 below the initial cost of €5.50.

a Find an expression, in terms of x, for the bus fare.

b Find an expression, in terms of x, for the number of people who ride the bus in a day.

c Find an expression, in terms of x, for the daily revenue generated by people riding the bus.

d Find the number of fare decreases that result in a revenue of €4500.

e Find an appropriate domain for this context.

4 The shape of an archway is modelled by the graph of a quadratic function. The maximum height of the archway is 4 m and the maximum width is 4 m. The graph shows a model of the archway.

a Find a function to model the archway.

b Use the function to determine whether an object 3 m wide and 1.6 m tall will fit through the archway.

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5 A rectangle has length x m and perimeter 310 m.

a Find a function for the area of the rectangle in terms of x.

b Use the function to find the dimensions of the rectangle with the maximum possible area.

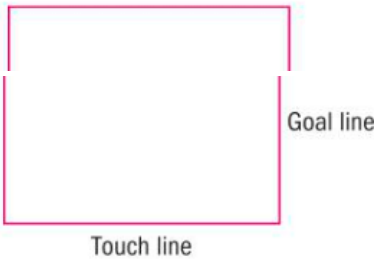
FIFA (Fédération Internationale de Football Association), the governing body for international football (soccer), sets restrictions on the dimensions of the rectangular playing field.

FIFA's rules give the following limitations on the dimensions of a regulation football field.

The length of the touch line must be greater than the length of the goal line.

Touch line: minimum 90 m maximum 120 m

Goal line: minimum 45 m maximum 90 m



c Suppose a football field has perimeter 310 m. Determine whether the dimensions you found in part **b** meet the requirements for a FIFA regulation field width. Explain your reasoning.

d Suppose the function you found in part **a** is used to model the area of a regulation FIFA football field with perimeter 310 m and a touch line of length x. Write down the appropriate domain for this function.

e Find the maximum area of a football field with perimeter 310 m that meets FIFA's regulations.

TOK

We have seen the involvement of several nationalities in the development of quadratics in the chapter.

To what extent do you believe that mathematics is a product of human social collaboration?

If not done, try this Practice Assignment, too…

Completed during the video lesson.

Exercise 3W

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