

# Quadratic Inequalities

## FORMULAE LIST

### Circle:

The equation  $x^2 + y^2 + 2gx + 2fy + c = 0$  represents a circle centre  $(-g, -f)$  and radius  $\sqrt{g^2 + f^2 - c}$ .

The equation  $(x-a)^2 + (y-b)^2 = r^2$  represents a circle centre  $(a, b)$  and radius  $r$ .

### Scalar Product:

$\mathbf{a} \cdot \mathbf{b} = |\mathbf{a}| |\mathbf{b}| \cos \theta$ , where  $\theta$  is the angle between  $\mathbf{a}$  and  $\mathbf{b}$

or  $\mathbf{a} \cdot \mathbf{b} = a_1 b_1 + a_2 b_2 + a_3 b_3$  where  $\mathbf{a} = \begin{pmatrix} a_1 \\ a_2 \\ a_3 \end{pmatrix}$  and  $\mathbf{b} = \begin{pmatrix} b_1 \\ b_2 \\ b_3 \end{pmatrix}$ .

### Trigonometric formulae:

$$\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$$

$$\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$$

$$\sin 2A = 2 \sin A \cos A$$

$$\cos 2A = \cos^2 A - \sin^2 A$$

$$= 2 \cos^2 A - 1$$

$$= 1 - 2 \sin^2 A$$

### Table of standard derivatives:

$f(x)$	$f'(x)$
$\sin ax$	$a \cos ax$
$\cos ax$	$-a \sin ax$

### Table of standard integrals:

$f(x)$	$\int f(x) dx$
$\sin ax$	$-\frac{1}{a} \cos ax + c$
$\cos ax$	$\frac{1}{a} \sin ax + c$

## Essential Skills 6

The skills in this series of worksheets appear frequently.

These are the GIFTS you must take to succeed



### Solving Quadratic Inequalities

By sketching the parabola, solve:

1.  $x^2 - 4x \geq 0$

2.  $x^2 + 14x + 33 \leq 0$

3.  $x^2 - x - 20 > 0$

4.  $x^2 - 9x + 8 < 0$

5.  $x^2 - 16 \geq 0$

6.  $3x^2 - 27 \leq 0$

7.  $2x^2 + 5x - 3 < 0$

8.  $7 - 6x - x^2 \geq 0$

9.  $4x^2 \geq 8x + 5$

10.  $6 + 7x \leq 3x^2$



### APPLYING QUESTIONS

- Find the values of  $x$  for which the function  $f(x) = x^3 + 5x^2 - 8x + 3$  is increasing.
- $x^2 - (k - 2)x + 4 = 0$  has no real roots  
Find the range of values for  $k$ .
- A circle has equation  $x^2 + y^2 - 2kx - ky - 7k + 3 = 0$ .  
Find the range of values for  $k$ .

## Essential Skills 6 - Answers

1	$x \leq 0, x \geq 4$
2	$-11 \leq x \leq -3$
3	$x < -4, x > 5$
4	$1 < x < 8$
5	$x \leq -4, x \geq 4$
6	$-3 \leq x \leq 3$
7	$-3 < x < \frac{1}{2}$
8	$-7 \leq x \leq 1$
9	$x \leq \frac{1}{2}, x \geq \frac{5}{2}$
10	$x \leq -\frac{2}{3}, x \geq 3$
AQ	(1) $x < -4; x > \frac{2}{3}$ (2) $-2 < k < 6$ (3) $k < -6, k > \frac{2}{5}$

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