# Timester Challenge

## Completing the Square

Express the following expressions in the form $(x + a)^2 + b$, where $a$ and $b$ are constants.

*a)* $x^2 + 4x + 9$

*b)* $x^2 + 8x - 12$

Bronze

The point $(-2, -3)$ is the turning point of $y = x^2 + ax + b$, where $a$ and $b$ are integers. Find the values of $a$ and $b$.

Silver

$3x^2 + 12x + 7$ can be written in the form $a(x + b)^2 + c$ where $a, b$ and $c$ are constants.

a) Find the values of $a, b$ and $c$.

a) Write down the coordinates of the turning point of the graph $y = x^2 - 6x + 4$.

b) Is this a maximum or a minimum?

Maximum ☐ Minimum ☐

Bronze

$x^2 + 10x - 8 = (x + p)^2 - q$ where $p$ and $q$ are constants.

a) Find the values of $p$ and $q$.

b) Hence Solve $x^2 + 10x - 8 = 0$

Silver

b) Using your answer to part (a) solve $3x^2 + 12x + 7 = 7$

Gold

# Timester Challenge

## Completing the Square

## Answers

Express the following expressions in the form $(x+a)^2+b$, where $a$ and $b$ are constants.

*a)* $x^2+4x+9$

$(x+2)^2-4+9$
$=(x+2)^2+5$

$a=2\ and\ b=5$

*b)* $x^2+8x-12$

$(x+4)^2-16+12$
$=(x+4)^2-4$

$a=4\ and\ b=-4$

Bronze

The point $(-2,-3)$ is the turning point of $y=x^2+ax+b$, where $a\ and\ b$ are integers. Find the values of $a\ and\ b$.

$y=(x+2)^2-3$
$y=x^2+4x+4-3$
$y=x^2+4x+1$

$a=4\ and\ b=1$

Silver

$3x^2+12x+7$ can be written in the form $a(x+b)^2+c$ where $a, b\ and\ c$ are constants.

a) Find the values of $a, b$ and $c$.

$3(x^2+4)+7$
$=3\big((x+2)^2-4\big)+7$
$=3(x+2)^2-12+7$
$=3(x+2)^2-5$

$a=3, b=2\ and\ c=-5$

b) Using your answer to part (a) solve

$3x^2+12x+7=7$

$3(x+2)^2-5=7$
$3(x+2)^2=12$
$(x+2)^2=4$
$x+2=\pm\sqrt{4}$
$x=2\pm2$
$x=0\ and\ x=4$

Gold

a) Write down the coordinates of the turning point of the graph $y=x^2-6x+4$.

$(x-3)^2-9+4$
$=(x-3)^2-5$

$Turning\ Point$
$(3,-5)$

b) Is this a maximum or a minimum?

Maximum ☐ Minimum ☑

Bronze

$x^2+10x-8=(x+p)^2-q$ where $p$ and $q$ are constants.

a) Find the values of $p\ and\ q$.

$(x+5)^2-25-8$
$=(x+5)^2-33$

$p=5\ and\ q=-33$

b) Hence Solve $x^2+10x-8=0$

$(x+5)^2-33=0$
$(x+5)^2=33$
$x+5=\pm\sqrt{33}$

$x=-5-\sqrt{33}$
$x=-5+\sqrt{33}$

Silver