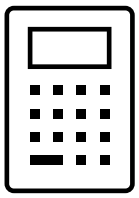
Surname:	Forename(s):

GCSE Mathematics

Completing the Square



Grade 8

These questions get more difficult as your go through this paper.

This topic could come up on a calculator paper and non-calculator paper.

Materials

- **Formulae Sheet** (on the next page)
- **Black** ink or ball-point pen
- Pencil
- Eraser
- Protractor
- Compass
- Tracing Paper
- **Calculator allowed**

Instructions

- Show **all** of your working.
- Draw diagrams in pencil.
- Plot graphs in pencil.
- Diagrams are **not** accurately drawn, unless otherwise indicated.

Higher Tier Formulae Sheet

Perimeter, Area and Volume

Where a and b are the lengths of the parallel sides and h Is their perpendicular separation:

Area of a trapezium = ½ (a + b) h

Volume of a prism = area of cross section x length

Where r is the radius and d is the diameter:

Circumference of a circle = 2πr = πd

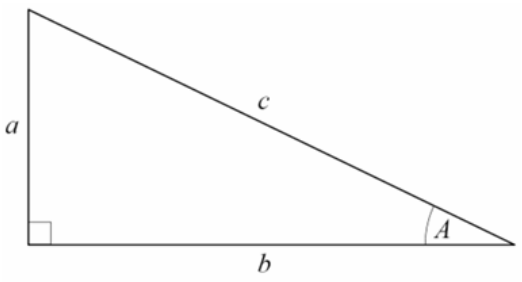
Area of a circle = πr^2

Quadratic Formula

The solution of $ax^2 + bx + c = 0$ where $a \neq 0$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Pythagoras' Theorem and Trigonometry

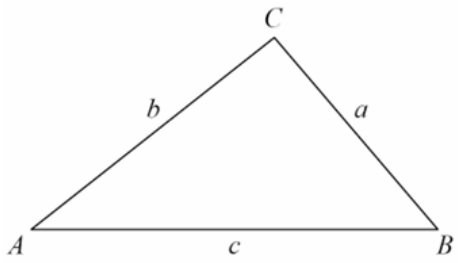


In any right-angled triangle where a, b and c are the length of the sides and c is the hypotenuse:

$$a^2 + b^2 = c^2$$

In any right-angled triangle ABC where a, b and c are the length of the sides and c is the hypotenuse:

$$\sin A = \frac{a}{c} \qquad \cos A = \frac{b}{c} \qquad \tan A = \frac{a}{b}$$



In any triangle ABC where a, b and c are the length of the sides:

$$\text{sine rule: } \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$\text{cosine rule: } a^2 = b^2 + c^2 - 2bc \cos A$$

$$\text{Area of triangle } = \frac{1}{2} ab \sin C$$

Compound Interest

Where P is the principal amount, r is the interest rate over a given period and n is number of times that the interest is compounded:

$$\text{Total accrued} = P\left(1 + \frac{r}{100}\right)^n$$

Probability

Where P (A) is the probability of outcome A

and P (B) is the probability of outcome B:

P (A or B) = P (A) + P (B) – P (A and B)

P (A and B) = P (A given B) P(B)

1 Write down the coordinates for the turning point of the graph $y = (x + 3)^2 + 9$

(_____ , _____)

(Total for question 1 is 1 mark)

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2 Write down the coordinates for the turning point of the graph $y = (x + 7)^2 - 8$

(_____ , _____)

(Total for question 2 is 1 mark)

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3 Write down the coordinates for the turning point of the graph $y = (x - 2)^2 + 2$

(_____ , _____)

(Total for question 3 is 1 mark)

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4 Write down the coordinates for the turning point of the graph $y = (x - 5)^2 - 4.25$

(_____ , _____)

(Total for question 4 is 1 mark)

5 Write down the coordinates for the turning point of the graph $y = 2(x - 3)^2 + 6$

(_____ , _____)

(Total for question 5 is 1 mark)

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6 Write down the coordinates for the turning point of the graph $y = \frac{2}{3}(x + 6)^2 + 9$

(_____ , _____)

(Total for question 6 is 1 mark)

---

7 (a) Write $x^2 + 4x - 5$ in the form $(x + a)^2 + b$, where a and b are integers.

_____

(2)

(b) Hence, or otherwise, write down the coordinates of the turning point of the graph $y = x^2 + 4x - 5$

(_____ , _____)

(1)

(Total for question 7 is 3 marks)

8 (a) Write $x^2 - 10x + 2$ in the form $(x + a)^2 + b$, where a and b are integers.

_____

(2)

(b) Hence, or otherwise, write down the coordinates of the turning point of the graph
$y = x^2 - 10x + 2$

(_____ , _____)

(1)

(Total for question 8 is 3 marks)

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9 (a) Write $2x^2 + 8x - 3$ in the form $a(x + b)^2 + c$, where a, b and c are integers.

_____

(3)

(b) Hence, or otherwise, write down the coordinates of the turning point of the graph
$y = 2x^2 + 8x - 3$

(_____ , _____)

(1)

(Total for question 9 is 4 marks)

10 (a) Write $3x^2 - 6x - 7$ in the form $a(x + b)^2 + c$, where a, b and c are integers.

_____

(3)

(b) Hence, or otherwise, write down the coordinates of the turning point of the graph
$y = 3x^2 - 6x - 7$

(_____ , _____)

(1)

(Total for question 10 is 4 marks)

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11 (a) Write $2x^2 + 10x + 4$ in the form $a(x + b)^2 + c$, where a, b and c are integers.

_____

(3)

(b) Hence, or otherwise, write down the coordinates of the turning point of the graph
$y = 2x^2 + 10x + 4$

(_____ , _____)

(1)

(Total for question 11 is 4 marks)

12 (a) Write $3x^2 - 4x + 10$ in the form $a(x + b)^2 + c$, where a, b and c are integers.

_____

(3)

(b) Hence, or otherwise, write down the coordinates of the turning point of the graph
$y = 3x^2 - 4x + 10$

(_____ , _____)

(1)

(Total for question 12 is 4 marks)

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13 (a) Write $7x^2 + 5x - 4$ in the form $a(x + b)^2 + c$, where a, b and c are integers.

_____

(3)

(b) Hence, or otherwise, write down the coordinates of the turning point of the graph
$y = 7x^2 + 5x - 4$

(_____ , _____)

(1)

(Total for question 13 is 4 marks)

14 By completing the square, solve $x^2 + 4x + 3 = 0$

x = _____

(Total for question 14 is 5 marks)

15 By completing the square, solve $x^2 - 8x + 5 = 0$
Give your answer in surd form.

x = _____

(Total for question 15 is 5 marks)