Factorising/Expanding/Solving Polynomials (H)

A collection of 9-1 Maths GCSE Sample and Specimen questions from AQA, OCR, Pearson-Edexcel and WJEC Eduqas.

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Total Marks:	

1. Factorise the following expressions.

a) $6x^2 + 8x$

$2x(3x + 4)$

[2]

b) $x^2 - 100$

$(x + 10)(x - 10)$

[1]

2. Express $x^2 + 12x + 14$ in the form $(x + a)^2 + b$, where a and b are whole numbers to be found.

$(x + 6)^2 - 36 + 14 = (x + 6)^2 - 22$ $\quad a = 6$, $b = -22$

[2]

3. Expand and simplify $(m + 7)(m + 3)$

$m^2 + 3m + 7m + 21 = m^2 + 10m + 21$

[2]

4. Factorise fully $20x^2 - 5$

$5(4x^2 - 1) = 5(2x + 1)(2x - 1)$

difference of 2 squares

[2]

5. Circle the equation with roots 4 and -8 $\quad x - 4 \quad x + 8$

× $4x(x - 8) = 0$ $\quad$ $(x - 4)(x + 8) = 0$

$x^2 - 32 = 0$ $\quad$ $(x + 4)(x - 8) = 0$

[1]

6. Factorise $y^2 + 7y + 6$

$(y + 1)(y + 6)$

[2]

$-\frac{9}{2}+5 = -\frac{9}{2}+\frac{10}{2} = \frac{1}{2}$

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7. $2x^2 - 6x + 5$ can be written in the form $a(x - b)^2 + c$

where a, b and c are positive numbers.

(a) Work out the values of a, b and c.

$2(x^2 - 3x) + 5$

$2\left[\left(x - \frac{3}{2}\right)^2 - \frac{9}{4}\right] + 5$

$= 2\left(x - \frac{3}{2}\right)^2 - \frac{9}{2} + 5$

$2\left(x - \frac{3}{2}\right)^2 + \frac{1}{2}$

a = 2

b = 3/2

c = 1/2

[3]

(b) Using your answer to part (a), or otherwise, solve $2x^2 - 6x + 5 = 8.5$

$2 = \frac{4}{4}$

$2\left(x - \frac{3}{2}\right)^2 + \frac{1}{2} = 8.5$

$2\left(x - \frac{3}{2}\right)^2 = 8$

$\left(x - \frac{3}{2}\right)^2 = 4$

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

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

$\frac{3}{2} + 2 = \frac{7}{2} = 3.5$

$\frac{3}{2} - 2 = -0.5$

$x = 3.5, \; x = -0.5$

[3]

8. (a) Find the interval for which $x^2 - 7x + 10 \leq 0$

$(x - 5)(x - 2) \leq 0$

$x \leq 5 \quad x \leq 2$

(a) ..... 2 ..... $\leq x \leq$ ..... 5 ..... [3]

(b) The point (-3, -4) is the turning point of the graph of $y = x^2 + ax + b$, where a and b are integers.

Find the values of a and b.

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

$y = x^2 + 6x + 9 - 4$

$y = x^2 + 6x + 5$

(b) a = ... 6 ..... b = ... 5 ..... [3]

6. $y = 6x^4 + 7x^2$ and $x = \sqrt{w + 1}$.

$x^2 = w + 1$ $\quad x^4 = x^2 \times x^2 = (w + 1)(w + 1)$

Find the value of w when $y = 10$.

Show your working.

$y = 6(w + 1)(w + 1) + 7(w + 1)$

$10 = 6(w^2 + 2w + 1) + 7w + 7$

$0 = -10 + 6w^2 + 12w + 6 + 7w + 7$

$0 = 6w^2 + 19w + 3$ $\quad (6w + 1)(w + 3) = 0$

$\therefore w = -\frac{1}{6}$ or $w = -3$

[6]

$3 \times 8 = 24$ (1, 24) (2, 12)

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7. Factorise $3x^2 + 14x + 8$

$3x^2 + 12x + 2x + 8$

$= 3x(x+4) + 2(x+4)$

$= (3x+2)(x+4)$ [2]

11. a) Write $x^2 + 10x + 29$ in the form $(x + a)^2 + b$.

$(x + 5)^2 - 25 + 29$

$(x+5)^2 + 4$

a) $(x+5)^2 + 4$ [3]

b) Write down the coordinates of the turning point of the graph of $y = x^2 + 10x + 29$.

b) (-5 , 4) [1]

12. a) Expand and simplify.

$(x + 7)(x + 2)$

a) $x^2 + 9x + 14$ [2]

b) Factorise completely.

$2x^2 - 6xy$

b) $2x(x - 3y)$ [2]

c) Solve.

$x^2 + 5x = 24$

1, 24 , 2, 12
3, 8

$x^2 + 5x - 24 = 0$

$(x + 8)(x - 3) = 0$

c) $x = -8 \quad x = 3$ [3]

13. Factorise $x^2 + 3x - 4$

$(x + 4)(x - 1)$

[2]

14.Factorise $y^2 + 27y$

$y(y + 27)$ [1]

15. Expand and simplify (y + 5)(y - 4)

$y^2 - 4y + 5y - 20 = y^2 + 5y - 20$

[2]

16. $x(x + 4) \equiv x^2 + 4x$

For how many values of x is $x(x + 4)$ equal to $x^2 + 4x$?

Circle your answer.

[1]

0 1 2 all

17. Factorise fully $9a^2 - 6a$

$3a(3a - 2)$

[2]

18. Write $x^2 + 2x - 8$ in the form $(x + m)^2 + n$

where m and n are integers.

$(x+1)^2 - 1 - 8 = (x+1)^2 - 9$

[2]

19. a) Write $2x^2 + 16x + 35$ in the form $a(x + b)^2 + c$ where a, b, and c are integers.

$2(x^2 + 8x) + 35 = 2[(x+4)^2 - 16] + 35$

$= 2(x+4)^2 - 32 + 35 = 2(x+4)^2 + 3$

..... [3]

b) Hence, or otherwise, write down the coordinates of the turning point of the graph of $y = 2x^2 + 16x + 35$

$(-4, 3)$

[1]

20. Solve $x^2 - 6x - 8 = 0$ $a = 1$ $b = -6$ $c = -8$

Write your answer in the form $a \pm \sqrt{b}$ where a and b are integers.

$x = \frac{-(-6) \pm \sqrt{(-6)^2 - 4 \times 1 \times -8}}{2} = \frac{6 \pm \sqrt{36 + 32}}{2}$

$= \frac{6 \pm \sqrt{68}}{2} = \frac{6 \pm \sqrt{4}\sqrt{17}}{2}$ $x = 3 \pm \sqrt{17}$

..... [3]

21. Show that

$$(3x - 1)(x + 5)(4x - 3) = 12x^3 + 47x^2 - 62x + 15$$

for all values of x.

LHS $(3x-1)[4x^2-3x+20x-15)$

$(3x-1)(4x^2+17x-15)$

$12x^3+51x^2-45x-15-4x^2-17x+15$

$= 12x^3+47x^2-62x+15$ $\therefore$ LHS = RHS [3]

22. Expand and simplify $(2x + 5)(2x - 5)(3x + 7)$

difference of two squares

$(4x^2-25)(3x+7) = 12x^3+28x^2-75x-175$

[3]

23. Expand and simplify $(2x + 5y)(3x - 8y)$

$6x^2 - 16xy + 15xy - 40y^2$

$6x^2 - xy - 40y^2$

[3]

24. $2x^2 - 20x + c \equiv a(x - b)^2 + 3b$

Work out the value of c.

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

$2[(x-5)^2-25]+c = a(x-b)^2+3b$ $\therefore b = 5$

$-50 + c = 15$ $c = 65$ [3]

25. $(3x + 1)(x - 2) + ax + b \equiv 3x^2 + 8x - 5$

Work out the values of a and b.

LHS $3x^2-6x+x-2+ax+b \equiv 3x^2+8x-5$

$3x^2-5x+ax-2+b$

equating coefficient $(-5+a) = 8$ $-2+b = -5$

$a = 13$ $b = -3$ [4]

26. Write $x^2 - 10x + 29$ in the form $(x - a)^2 + b$

$(x-5)^2-25+29$

$(x-5)^2+4$

[2]

CREDITS AND NOTES

Q	Awarding Body	Q	Awarding Body	Q	Awarding Body
1	WJEC Eduqas	12	OCR	23	AQA
2	WJEC Eduqas	13	Pearson Edexcel	24	AQA
3	Pearson Edexcel	14	Pearson Edexcel	25	AQA
4	Pearson Edexcel	15	AQA	26	AQA
5	AQA	16	AQA		
6	Pearson Edexcel	17	AQA		
7	AQA	18	Pearson Edexcel		
8	OCR	19	Pearson Edexcel		
9	OCR	20	Pearson Edexcel		
10	OCR	21	Pearson Edexcel		
11	OCR	22	AQA		

Notes:

These questions have been retyped from the original sample/specimen assessment materials and whilst every effort has been made to ensure there are no errors, any that do appear are mine and not the exam board s (similarly any errors I have corrected from the originals are also my corrections and not theirs!).

Please also note that the layout in terms of fonts, answer lines and space given to each question does not reflect the actual papers to save space.

These questions have been collated by me as the basis for a GCSE working party set up by the GLOW maths hub - if you want to get involved please get in touch. The objective is to provide support to fellow teachers and to give you a flavour of how different topics "could" be examined. They should not be used to form a decision as to which board to use. There is no guarantee that a topic will or won't appear in the "live" papers from a specific exam board or that examination of a topic will be as shown in these questions.

Links:

AQA http://www.aqa.org.uk/subjects/mathematics/gcse/mathematics-8300

OCR http://ocr.org.uk/gcsemaths

Pearson Edexcel http://qualifications.pearson.com/en/qualifications/edexcel-gcses/mathematics-2015.html

WJEC Eduqas http://www.eduqas.co.uk/qualifications/mathematics/gcse/

Contents:

This version contains questions from:

AQA – Sample Assessment Material, Practice set 1 and Practice set 2

OCR – Sample Assessment Material and Practice set 1

Pearson Edexcel – Sample Assessment Material, Specimen set 1 and Specimen set 2

WJEC Eduqas – Sample Assessment Material