****

YEAR 10 MATHS – ALGEBRA & NUMBER

TARGET GRADE 6

SUMMER LEARNING PROGRAMME

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**Algebra: Simplifying, expanding brackets and factorising**

**1.** (a) Factorise 10*p* – 4

.....................................................................................................................................  **(1)**

 (b) Factorise *q*2 + 3*q*

..................................................................................................................................... (1)

 (c) Factorise *r*2 – *r*

..................................................................................................................................... (1)

**2.** (a) Factorise 10*a* + 5

..................................................................................................................................... (1)

(b) Factorise *c*2 – 4*c*

..................................................................................................................................... (2)

**3.** Factorise

(a) 4*x*  8

..................................................................................................................................... (1)

(b) *y*2*+* 2*y*

..................................................................................................................................... (2)

 **4.** (a) Simplify 5*p* + 2*q* – *q* + 2*p*

...................................................................................................................................... (2)

 (b) Multiply out 4(*r* – 3)

...................................................................................................................................... (1)

**5.** (a) Expand 3(*y* – 4)

.................................................................................................................................... (1)

(b) Simplify the expression 2*c* + 6*d* + 4*c* – 8*c*

.................................................................................................................................... (2)

 (c) Factorise *x*2 + 5*x*

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**6.** Expand and simplify 4(3*d* – 2*e*)  (2*d* – 5*e*)

 ..................................................................................................................................... (2)

**7.** Expand and simplify 5(2*x* + 1) – 3(*x* – 4)

 ...................................................................................................................................... (2)

**8.** (a) Simplify 2*x* + 3*y* + 5*x* – 2*y* – 4*x*

...............…………………………………………………………………………….. (2)

 (b) Factorise 4*c* + 12

...............…………………………………………………………………………….. (1)

(c) Factorise *x*2 + 5*x*

...............…………………………………………………………………………….. (2)

**9.** Expand and simplify

 (a) 5(2*a* – *c*) + 4(3*a* + 2*c*)

...............…………………………………………………………………………….. (2)

 (b) Expand and simplify 3(2*x* – 1) + 2(3*x* + 5)

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 (c) Expand and simplify (*y* + 5)(*y* – 1)

 ..................................................................................................................................... (2)

 (d) Factorise 2*xy* – 6*y*2

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**10.** (a) Factorise 2*x* + 6

 .................................................................................................................................... (1)

 (b) Expand 3(4*y* + 1)

 ..................................................................................................................................... (1)

 (c) Expand 4*x*(*x*2 + 5)

 ..................................................................................................................................... (2)

**11.** Factorise fully 2*x*2 – 50*y*2

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……………...........……………..…….....…..........…………………………………. (3)

**12.** Factorise 5*x*2 + 20*x*

..................................................................................................................................... (1)

**13.** Factorise fully 

………………………………………………………………………………………. (2)

**14.** Factorise fully 6*a*2*b* + 9*ab*2

..................................................................................................................................... (2)

**15.** Factorise completely 3*x*2 – 6*xy*

...................................................................................................................................... (2)

**16.** Factorise *r*6 – 3*r*4

..................................................................................................................................... (1)

**Algebra: Solving Linear Equations**

**1.** Solve the following equations

 (a) 4(*y* – 3) = 18

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(b)  = 11

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..................................................................................................................................... (2)

**2.** Solve the equation 2(*x* + 5) = 7 – 4*x*

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**3.** Solve the equation 4*z* + 8 = 3 – *z*

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**4.** Solve the equation 

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..................................................................................................................................... (3)

**5.** Solve 

……………………………………………………………………………………….

………………………………………………………………………………………. (2)

**6.** Solve 

……………………………………………………………………………………….

………………………………………………………………………………………. (3)

**7.** Solve the equation 6*y* + 7 = 14*y*

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..................................................................................................................................... (2)

**8.** Solve the equation 4(*y* – 3) = 18

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..................................................................................................................................... (3)

**9.** Solve the equation 7*z* – 3 = 6 + *z*

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…………..........…............……..……...................…………………………………. (3)

**10.** Solve the following equations

(a) = 11
.....................................................................................................................................

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 (b) 2*x* – 3 = 5*x* + 6

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**11.** Solve the equation 

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**12.** Solve the equation

9(*x* – 1) = 5(*x* – 2)

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**13.** Solve the equation

 = 2

 You **must** show all your working.

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…................................................................................................................................ (4)

 **14.** Solve the equation 

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**15.** Solve the equation4(*z* – 1) = 2(*z* + 3)

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**16.** Solve the equation 

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……………………………………………………………………………………….

………………………………………………………………………………………. (3)

**17.** Solve the equation 3(2*z* – 1) + 4(*z* + 3) = 5(2*z* – 1) + 4(3*z* – 1)

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………...…............……..............................…………….....…………....................... (3)

**Algebra: Solving Simultaneous Linear Equations**

**1.** Solve the simultaneous equations:

2*x* + 3*y* = 9
3*x* + 2*y* = 1

 You **must** show all your working.
Do **not** use trial and improvement.

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Answer *x* = .........................., *y* = .............................. (4)

**2.** Solve the simultaneous equations

 4*x* + 3*y* = 5
2*x* – 5*y* = 9

 You **must** show your working.
Do **not** use trial and improvement.

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Answer *x* = ....................... , *y* = ..........................

 (4)

**3.** Solve the simultaneous equations

 5*x* + 3*y* = 13
3*x* + 5*y* = 3

 You **must** show your working.
Do **not** use trial and improvement.

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Answer *x* = ..................., *y* = ........................

(4)

**4.** Solve the simultaneous equations 4*x* + 3*y* = 14 2*x* + *y* = 5

 You **must** show your working.
Do **not** use trial and improvement.

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Answer *x* = ....................... , *y* = ..........................

 (4)

**5.** Dario and Ewan buy clothes in a sale.

|  |  |  |
| --- | --- | --- |
| **BARGAIN SWEATERSALL ONE PRICE** |  | **CUT-PRICEJEANS** |

 Dario buys a sweater and a pair of jeans. These cost him £9.20.
Ewan buys 3 sweaters and a pair of jeans. These cost him £15.10.

 What is the cost of a sweater?

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Answer £ .....................................................................

 (4)

**Algebra: Changing the Subject of a Formula**

**1.** Make *t* the subject of the formula *w =* 2*t* + *v*

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**2.** Make *c* the subject of the formula *E* = *mc*2

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**3.** Make *c* the subject of the formula *d* = + *e*

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............................................................................................................................................... (2)

**4.** Make *x* the subject of 

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……………………………………………………………………………………………… (2)

**5.** Make *u* the subject of the formula 

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**6.** Make *t* the subject of the formula *w =  – v*

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**7.** Make *r* the subject of the formula  *p* = 3 + 2*r*

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**8.** Make *x* the subject of the formula

3*x* + 2*y* = 8*y* – 3

 Simplify your answer as much as possible.

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…........................................................................................................................................... (3)

**Number: Rules of Indices**

**1.** Simplify

(a) *y*4  *y*–3

........................................................................................................................... (1)

 (b) *y*4  *y*5

........................................................................................................................... (1)

**2.** Simplify

(a) *c* × *c* × *c* × *c*

..................................................................................................................................... (1)

(b) *d*3 × *d*2

..................................................................................................................................... (1)

 (c) 

..................................................................................................................................... (1)

 (d) (2*g*2*h*4) × (3*g*3*h*)

..................................................................................................................................... (2)

**3.** (a) Simplify

(i) *y*7 × *y*2

........................................................................................................................... (1)

 (ii) *y*7  *y*2

........................................................................................................................... (1)

(iii) (*y*7)2

........................................................................................................................... (1)

**4.** Simplify (3*xy*2)4*.*

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.....................................................................................................................................

..................................................................................................................................... (2)

**5.** Simplify

(i) *w* 2 × *w*6

........................................................................................................................... (1)

(ii) *w*10  *w*4

........................................................................................................................... (1)

(iii) ( *w* 4)3

............................................................................................................................ (1)

**6.** If *x* = 3 *p* and *y* = 3*q*

Express in terms of *x* and/or *y*

(i) 3*p – q*

........................................................................................................................... (1)

 (ii) 32 *p*

........................................................................................................................... (1)

 (iii) 3 *q* + 2

........................................................................................................................... (1)

**7.** (a) Simplify (2*x*4*y*)3

……………...........……………..…….....…..........………………………………….

……………...........……………..…….....…..........………………………………….

……………...........……………..…….....…..........…………………………………. (2)

**8.** (a) Simplify 

………………………………………………………………………………………. (1)

 (b) Simplify 

………………………………………………………………………………………. (1)

 (c) Simplify 

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………………………………………………………………………………………. (2)

**11.** (a) Work out the value of 57 ÷ 54

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...................................................................................................................................... (2)

**Number: Standard Form**

**1.** A builder has 7200 kg of sand.

(a) Write 7200 kg in grams.
Give your answer in standard form.

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...................................................................................................................................... (2)

 (b) One grain of this sand weighs 0.0006 g.
Write the weight of one grain of sand in standard form.

...................................................................................................................................... (1)

 (c) How many grains of sand are there in 7200 kg of sand?
Give your answer in standard form.

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...................................................................................................................................... (2)

**2.** (a) Write 7 billion as a number in standard form.

 1 billion = 1000 million

...............…………………………………………………………………………….. (1)

(b) Write the number 4.5 × 10–3 as an ordinary number.

...............…………………………………………………………………………….. (1)

**3.** Here are six numbers written in standard form.

2.6 × 105 1.75 × 106 5.84 × 100 8.2 × 10–3 3.5 × 10–1 4.9 × 10–2

(a) Write down the largest number.

Answer .................................................................. (1)

(b) Write down the smallest number.

 Answer .................................................................. (1)

(c) Write 4.9 × 10–2 as an ordinary number.

Answer .................................................................. (1)

(d) Work out 2.6 × 105 ÷ 0.1
Give your answer in standard form.

 Answer .................................................................. (1)

**4.** (a) Work out 4 × 107 × 3 × 104

 Give your answer in standard form.

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..................................................................................................................................... (2)

 (b) Work out 

 Give your answer in standard form.

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..................................................................................................................................... (3)

**5.** Work out (3 × 102) × (4 × 105)

 Give your answer in standard form.

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............................................................................................................................................... (2)

**6.** (a) Work out (3 × l02) × (4 × l05)

 Give your answer in standard form.

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..................................................................................................................................... (2)

(b) Workout (3 × l02)  (4 × l05)

Give your answer in standard form.

.....................................................................................................................................

..................................................................................................................................... (2)

**7.** Some large numbers are written below.

1 million = 106

1 billion = 109

1 trillion = 1012

 (a) How many millions are there in one trillion?

……………...........………………………….....……………………………………. (1)

 (b) Write 8 billion in standard form.

……………...........………………………….....……………………………………. (1)

 (c) Work out 8 billion multiplied by 3 trillion.
Give your answer in standard form.

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……………...........………………………….....……………………………………. (2)

**8.** (a) Work out 4 × 108 × 5 × 10–6

 Give your answer in standard form.

.....................………………………………………………………………………… (2)

 (b) Work out



 Give your answer in standard form.

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.....................………………………………………………………………………… (2)

**9.** Add together 5.1 × 107 and 3.89 × 106

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................................………………………………………………………………………… (2)

**10.** (a) Write these numbers in standard form

(i) 9 170 000

............................................................................................................................ (2)

 (ii) 0.000 048

............................................................................................................................ (1)

(b) Find the value of (1.8 × 1012)  (2 × 108)

.....................................................................................................................................

..................................................................................................................................... (2)

**Algebra: Factorising and Solving Quadratic Equations**

**1.** (a) Factorise *p*2 +7*p* + 12

..................................................................................................................................... (2)

(b) Solve the equation *p*2+ 7*p* + 12 = 0

..................................................................................................................................... (1)

**2.** Solve the equation *y*2 – 4*y* – 45 =0

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............................................................................................................................................... (3)

**3. (**a) Factorise *x*2 + 6*x* – 16

........................................................................................................................... (2)

 (b) Hence solve the equation *x*2 + 6*x* – 16 = 0

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........................................................................................................................... (1)

**4.** Sove the equation *z*2 – 9*z* + 8 = 0

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..................................................................................................................................... (3)

**5.** Solve the equation *y*2 + 5*y* = 0

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......……….............................................................................................................................. (3)

**6.** (a) (i) Factorise *x*2 – 7*x* – 8

.....……………………………………………………………………………..

.....…………………………………………………………………………….. (2)

(ii) Hence solve the equation *x*2 – 7*x* – 8 = 0

.....…………………………………………………………………………….. (1)

**9.** (a) Expand and simplify (*x + y*)(*x – y*)

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..................................................................................................................................... (2)

 (b) (i) Factorise *x*2 – 13*x* + 36

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............................................................................................................................ (2)

 (ii) Hence, or otherwise, solve the equation *x*2 – 13*x* + 36 = 0

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........................................................................................................................... (1)

**10.** (a) Factorise *x*2 + 5*x* – 14

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..................................................................................................................................... (2)

(b) Hence solve the equation *x*2 + 5*x* – 14 = 0

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..................................................................................................................................... (1)

**11.** (i) Factorise *y*2 – 8*y* + 15

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............................................................................................................................ (2)

 (ii) Hence solve the equation *y*2 – 8*y* + 15 = 0

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............................................................................................................................ (1)

**12.** (a) Factorise *x*2 *+* 3*x 40*

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..................................................................................................................................... (2)

 (b) Hence, solve the equation *x*2 *+* 3*x*40 = 0

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..................................................................................................................................... (1)

**13.** (a) Factorise *y*2– 5*y* + 6

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........................................................................................................................... (2)

 (b) Hence solve the equation *y*2– 5*y* + 6 = 0

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........................................................................................................................... (1)

**14.** Mandy is *x* years old.
Her brother is 5 years older than Mandy.
The product of their ages is 84.

(a) Show that *x*2 + 5*x* – 84 = 0

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..................................................................................................................................... (1)

(b) Solve *x*2 + 5*x* – 84 = 0

 Do **not** use a trial and improvement method.

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..................................................................................................................................... (3)

**15.** (a) (i) Factorise *x*2 – 10*x* + 25

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 (ii) Hence, or otherwise, solve the equation

(*y* – 3)2 – 10(*y* – 3) + 25 = 0

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.................………............................................................................................... (2)

**Algebra: Difference of Two Squares**

**1.** (a) Factorise *m*2 – 49

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..................................................................................................................................... (1)

**2.** (a) Show clearly that 

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………………………………………………………………………………………. (2)

(b) Factorise 

……………………………………………………………………………………….

………………………………………………………………………………………. (1)

**3.** Factorise *x*2  4

..................................................................................................................................... (1)

**4.** Factorise *h*2 *–* 25

.....................................................................................................................................

..................................................................................................................................... (1)

**Algebra: Linear Graphs**

**1.** (a) Complete this table of values for *y* = 2*x* – 1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *x* | –1 | 0 | 1 | 2 | 3 |
| *y* | –3 |  | 1 |  | 5 |

..................................................................................................................................... (1)

 (b) On the grid draw the graph of *y* = 2*x* – 1 for values of *x* from –1 to +3.



(2)

**2.** (a) On the grid below draw and label the lines *y* = –4 and *y* = 2*x* + 1



(4)

(b) Write down the coordinates of the point where the lines *y* = –4 and *y* = 2*x* + 1 cross.

Answer ( ...................., ......................)

(1)

**3.** The line *y* = –3 crosses the line *y = x* – 2 at the point *P*.
What are the coordinates of *P*?
You may use the grid below if you wish.

 (3)

**4.** (a) (i) Complete the table of values for *y =* 4*x –* 3

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *x* | 1 | 2 | 3 | 4 | 5 |
| *y* | 1 |  |  | 13 | 17 |

 (1)

(ii) On the grid draw the graph of *y =* 4*x –* 3 for values of *x* from 1 to 5



(2)

(b) Draw and label the line *y* = 7 on the grid.

(1)

**5.** (a) On the grid below, draw the graph of *y* = 2*x* – 3 for values of *x* from –2 to +3.



(3)

(b) The line *y* = 2 crosses *y* = 2*x* – 3 at *P*.

 Write down the coordinates of *P*.

Answer ( .................. , .................. )

(1)

**6.** On the grid below, draw the graph of *y* = 7 – *x* for values of *x* from 0 to 7.



(3)

**7.** Here are the equations of four straight lines.

Line 1: *y* = *x* + 4

Line 2: *y* = 3*x*

Line 3: *y* = 3*x* + 5

Line 4: *y* = –*x* + 5

(a) Which two lines are parallel?

..................................................................................................................................... (1)

 (b) Which two lines intersect the *y* axis at the same point?

..................................................................................................................................... (1)

**8.** (a) Write down the equation of a line that is parallel to the line *y* = 5*x*

...................................................................... (1)

 (b) Work out the gradient of the line *y* + 2*x* = 6

..................................................................................................................................... (2)

**9.** The diagram shows the points *A*(0,3) and *B*(3,15).



 Find the equation of the line *AB*.

.................................................................................................................................................. (3)

**10.**



Find the equation of the line L.

............................................................................................................................................... (3)

**11.** The diagram shows the graph of the equation *y* = *ax* + *b*



 Find the values of *a* and *b*.

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............................................................................................................................................... (3)

**12.** Find the equation of the line through (0, –2) and (4, 18).

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 ............................................................................................................................................... (3)

**13.** A sketch of the line 2*y* – *x* = 4 is shown.

 The line crosses the axes at *A* and *B*.



(a) Calculate the coordinates of *A* and *B*.

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...................................................................................................................................... (2)

 (b) Calculate the gradient of the line *AB*.

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...................................................................................................................................... (2)

**8.** Find the equation of the straight line passing through the point (0, 5) which is perpendicular to the line

*y* = *x* + 3

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……....................................................................................................................................... (2)

**Algebra: Inequalities and Regions**

**1.** Solve the inequality

5*x* + 3 > 10

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............................................................................................................................................... (2)

**2.** (a) *x* is an integer.

0 < *x*  3

 Write down all the possible values of *x.*

..................................................................................................................................... (2)

(b) *x* and *y* are integers.

0 < *x*  3

 *y* < *x*

*x* + *y* < 5

 Write down **two** pairs of values of *x* and *y* which satisfy all three inequalities.

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Answer (.................., ....................) and (.................., ....................) (2)

**3.** (a) Solve the inequality 3*x* + 7  13

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..................................................................................................................................... (2)

(b) A mathematics teacher says



 What is the **largest** integer the teacher could have thought of?

..................................................................................................................................... (2)

**4.** (a) Solve the inequality 3*x* + 5 ≤ 16

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..................................................................................................................................... (2)

(b) Write down the integer value satisfied by the inequality 5 < 2*x* < 7

.....................................................................................................................................

..................................................................................................................................... (2)

**5.** (a) Solve the inequality 3(*x* – 2)  9

.....................................................................................................................................

...................................................................................................................................... (3)

 (b) The inequality *x*  3 is shown on the number line below.



 Draw another inequality on the number line so that only the following integers satisfy both inequalities {–2, –1, 0, 1, 2, 3}

(1)

**6.** (a) List all the solutions of the inequality

4 < 2*n*  11

where *n* is an integer.

..................................................................................................................................... (2)

 (b) Solve the inequality

*4x +* 1 < 7

..................................................................................................................................... (2)

(c) Show that, for any value of *n,*

(*n +* 1)2 *> n*(*n +* 2)

..................................................................................................................................... (2)

**7.** (a) List the integer values of *x* such that

–2  *x* < 3

..................................................................................................................................... (2)

 (b) Solve the inequality

*x*2 > 64

..................................................................................................................................... (2)

**8.** (a) Solve the inequality 2*x* + 3  1

.................................……....................................................................................…... (2)

 (b) Write down the inequality shown by the following diagram.



.................................……....................................................................................…... (1)

 (c) Write down all the integers that satisfy both inequalities shown in parts (a) and (b).

..............................................................................................…................................... (1)

**9.** (a) List the integer values of *n* such that 3  3*n* < 18

...................................................................................................................................... (3)

(b)

(i) Find the equation of the line *PQ.*

............................................................... (1)

(ii) Write down **three** inequalities which together describe the shaded area.

........................................................................................................................... (3)

**10.** Match each of the **shaded** regions to one of these inequalities.

**A** *y*  –  + 2 **D** *y*  2*x* – 4

**B** *y*  + 2 **E** *y*  2*x* – 4

**C** *y*  – 2*x* + 4



Region **1** .....................................................................

Region **2** .....................................................................

Region **3** .....................................................................

Region **4** .....................................................................

(4)

**11.** (a) Solve the inequality 3*x –* 5  5 – *2x*

.....................................................................................................................................

Answer .......................................................

(2)

(b) The region *R* is shaded in the diagram.

Write down **three** inequalities which

 together describe the shaded region.

Answer .......................................................

.......................................................

.......................................................

(3)

**12.** On the grid below, indicate clearly the region defined by the three inequalities and mark the region with an *R*.

*x*  1
*y*  *x –* 1
*x + y*  7

*x*

*y*

8

7

6

5

4

3

2

1

0

0

1

2

3

4

5

6

7

8

(3)