

Firrhill High School
Mathematics Department

Level 5

Assessment Questions

Algebra

Breaking Brackets

Factorising

Functions

Changing the Subject of a Formula

Simplifying algebraic Fractions

Solving Equations & Inequations

Indices & Surds

(1) 2010 Paper 1 Q.3

Change the subject of the formula to s .

$$t = \frac{7s+4}{2}.$$

3

(2) 2010 Paper 1 Q.4

Two functions are given below.

$$f(x) = x^2 - 4x$$

$$g(x) = 2x + 7$$

(a) If $f(x) = g(x)$, show that $x^2 - 6x - 7 = 0$.

2

(b) Hence find **algebraically** the values of x for which $f(x) = g(x)$.

2

(3) 2010 Paper 2 Q.2

Expand fully and simplify

$$x(x-1)^2.$$

2

(4) 2009 Paper 1 Q.3

Given that

$$f(x) = x^2 + 3,$$

(a) evaluate $f(-4)$

2

(b) find t when $f(t) = 52$.

2

(5) 2009 Paper 1 Q.4

(a) Factorise

$$x^2 - 4y^2.$$

(b) Expand and simplify

$$(2x - 1)(x + 4).$$

(c) Expand

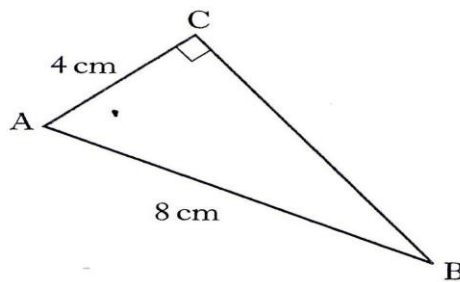
$$x^{\frac{1}{2}}(3x + x^{-2}).$$

	1	
	1	
	2	

(6) 2009 Paper 1 Q.5

In triangle ABC:

- angle $ACB = 90^\circ$
- $AB = 8$ centimetres
- $AC = 4$ centimetres.



Calculate the length of BC.

Give your answer **as a surd in its simplest form.**

KU	RE
3	

(7) 2009 Paper 1 Q.9

A formula used to calculate the flow of water in a pipe is

$$f = \frac{kd^2}{20}.$$

Change the subject of the formula to d .

3		

(8) 2008 Paper 1 Q.2

Factorise fully

$$5x^2 - 45.$$

2		
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(9) 2008 Paper 1 Q.3

$$W = BH^2.$$

Change the subject of the formula to H .

2		
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(10) 2008 Paper 1 Q.5

Express as a single fraction in its simplest form

$$\frac{1}{p} + \frac{2}{(p+5)}.$$

KU	R
2	

(11) 2008 paper 1 Q.6

Jane enters a two-part race.

(a) She cycles for 2 hours at a speed of $(x + 8)$ kilometres per hour.

Write down an expression in x for the distance cycled.

1		
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(b) She then runs for 30 minutes at a speed of x kilometres per hour.

Write down an expression in x for the distance run.

1		
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(c) The **total** distance of the race is 46 kilometres.

Calculate Jane's **running** speed.

(12) 2008 Paper 1 Q.9

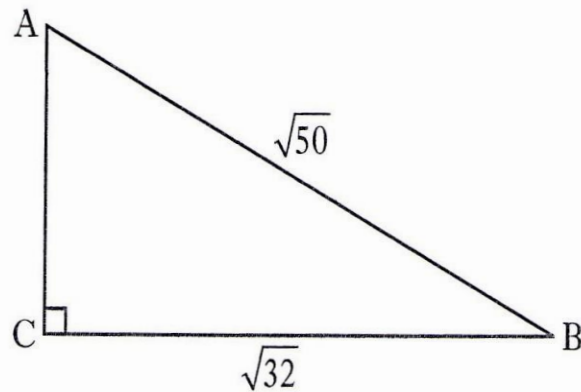
Simplify

$$m^3 \times \sqrt{m}.$$

2		
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(13) 2008 Paper 1 Q.11

A right angled triangle has dimensions as shown.



Calculate the length of AC, leaving your answer as a surd **in its simplest form**.

3

(14) 2008 Paper 1 Q.13

A new fraction is obtained by adding x to the numerator and denominator of the fraction $\frac{17}{24}$.

This new fraction is equivalent to $\frac{2}{3}$.

Calculate the value of x .

3

(15) 2007 Paper 1 Q.4

$$P = \frac{2(m-4)}{3}$$

Change the subject of the formula to m .

3

(16) 2007 Paper 1 Q.5

Remove brackets and simplify

$$(2x + 3)^2 - 3(x^2 - 6).$$

3

(17) 2008 Paper 2 Q.10

To hire a car costs £25 per day plus a mileage charge.

The first 200 miles are free with each additional mile charged at 12 pence.

<p>CAR HIRE</p> <p>£25 per day</p> <ul style="list-style-type: none">• first 200 miles free• each additional mile only 12p
--

- (a) Calculate the cost of hiring a car for 4 days when the mileage is 640 miles.
- (b) A car is hired for d days and the mileage is m miles where $m > 200$. Write down a formula for the cost £ C of hiring the car.

KU	RE
1	
	3

(18) 2007 Paper 1 Q.7

Remove brackets and simplify

$$a^{\frac{1}{2}}(a^{\frac{1}{2}} - 2).$$

2		

(19) 2007 Paper 2 Q.4

Solve the inequality

$$\frac{x}{4} - \frac{1}{2} < 5.$$

2		

(20) 2006 Paper 1 Q.3

Given that $f(x) = 4 - x^2$, evaluate $f(-3)$.

2		

(21) 2006 Paper 1 Q.6

(a) Factorise

$$4x^2 - y^2.$$

(b) Hence simplify

$$\frac{4x^2 - y^2}{6x + 3y}.$$

KU	RE
1	
2	

(22) 2006 Paper 1 Q.6

Solve the equation

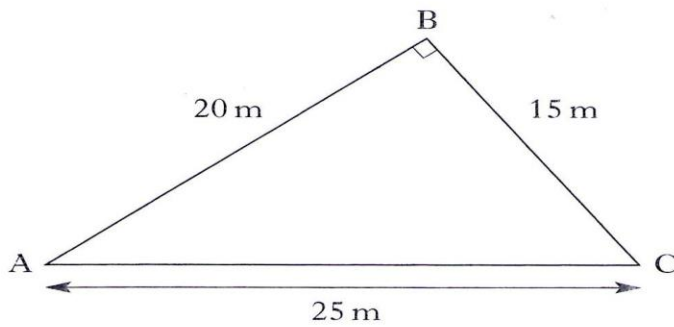
$$x - 2(x + 1) = 8.$$

3

(23) 2006 Paper 1 Q.8

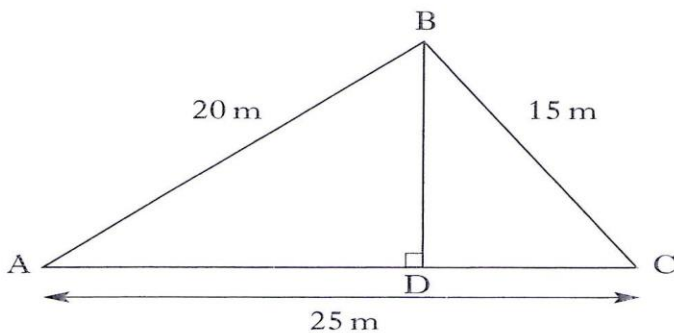
Triangle ABC is right-angled at B.

The dimensions are as shown.



(a) Calculate the area of triangle ABC.

(b) BD, the height of triangle ABC, is drawn as shown.



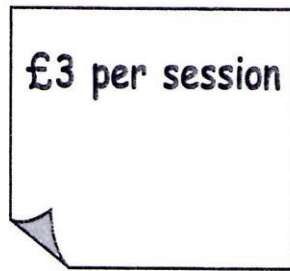
Use your answer to part (a) to calculate the height BD.

1

3

KU	RE
	1
1	
	2
	3

- (a) One session at the Leisure Centre costs £3.



Write down an algebraic expression for the cost of x sessions.

- (b) The Leisure Centre also offers a monthly card costing £20. The **first 6** sessions are then free, with each additional session costing £2.



- (i) Find the **total** cost of a monthly card and 15 sessions.
- (ii) Write down an algebraic expression for the **total** cost of a monthly card and x **sessions**, where x is greater than 6.
- (c) Find the minimum number of sessions required for the monthly card to be the cheaper option.

Show all working.

(25) 2006 Paper 2 Q.4

(a) Expand and simplify

$$(x + 4)(3x - 1).$$

(b) Expand

$$m^{\frac{1}{2}}(2 + m^2).$$

(c) Simplify, leaving your answer as a surd

$$2\sqrt{20} - 3\sqrt{5}.$$

KU

1

2

2

(26) 2005 Paper 1 Q.6

Solve the equation

$$\frac{2}{x} + 1 = 6.$$

3

(27) 2005 Paper 1 Q.9

(a) Emma puts £30 worth of petrol into the empty fuel tank of her car.

Petrol costs 75 pence per litre.

Her car uses 5 litres of petrol per hour, when she drives at a particular constant speed.

At this constant speed, how many litres of petrol will remain in the car after 3 hours.

(b) The next week, Emma puts £20 worth of petrol into the empty fuel tank of her car.

Petrol costs c pence per litre.

Her car uses k litres of petrol per hour, when she drives at another constant speed.

Find a formula for R , the amount of petrol remaining in the car after t hours.

KU RE

2

3

(28) 2005 Paper 1 Q.11

$$f(x) = 4\sqrt{x} + \sqrt{2}$$

(a) Find the value of $f(72)$ as a surd in its simplest form.

(b) Find the value of t , given that $f(t) = 3\sqrt{2}$.

KU	RE
3	
	3

(29) 2004 Paper 1 Q.3

$$A = 2x^2 - y^2.$$

Calculate the value of A when $x = 3$ and $y = -4$.

2

(30) 2004 Paper 1 Q.4

Simplify $\frac{3}{m} + \frac{4}{(m+1)}$.

3

(31) 2004 Paper 1 Q.11

(a) Simplify $2\sqrt{75}$.

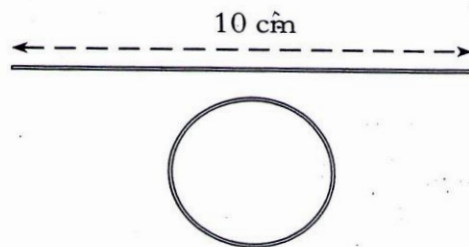
(b) Evaluate $2^0 + 3^{-1}$.

2

2

(32) 2004 Paper 1 Q.12

A piece of gold wire 10 centimetres long is made into a circle.



The circumference of the circle is equal to the length of the wire.

Show that the area of the circle is **exactly** $\frac{25}{\pi}$ square centimetres.

4

(33) 2003 Paper 1 Q.3

Simplify

$$3(2x - 4) - 4(3x + 1).$$

3

(34) 2003 Paper 1 Q.4

$$f(x) = 7 - 4x$$

(a) Evaluate $f(-2)$.

1

(b) Given that $f(t) = 9$, find t .

2

(35) 2003 Paper 1 Q.5

Factorise

$$2x^2 - 7x - 15.$$

2

(36) 2003 Paper 1 Q.12

(a) Evaluate

$$8^{\frac{2}{3}}.$$

2

(b) Simplify

$$\frac{\sqrt{24}}{\sqrt{2}}.$$

2

(37) 2003 Paper 2 Q.5

The number of diagonals, d , in a polygon with n sides is given by the formula

$$d = \frac{n(n-3)}{2}.$$

A polygon has 20 diagonals.

How many sides does it have?

4

(38) 2003 Paper 2 Q.11

(a) A driver travels from A to B, a distance of x miles, at a constant speed of 75 kilometres per hour.

Find the time taken for this journey in terms of x .

(b) The time for the journey from B to A is $\frac{x}{50}$ hours.

Hence calculate the driver's average speed for the whole journey.

KU	RE
1	
	4

(39) 2002 Paper 1 Q.3

Solve the inequality $5 - x > 2(x + 1)$.

3

(40) 2002 Paper 1 Q.4

Given that $f(x) = x^2 + 5x$, evaluate $f(-3)$.

2

(41) 2002 Paper 1 Q.5

(a) Factorise $p^2 - 4q^2$.

1

(b) Hence simplify

$$\frac{p^2 - 4q^2}{3p + 6q}$$

2

(42) 2002 paper 1 Q.6

$$L = \frac{1}{2}(h - t).$$

Change the subject of the formula to h .

2

(43) 2002 Paper 1 Q.10

Simplify

$$\sqrt{27} + 2\sqrt{3}.$$

KU	RE
2	

(44) 2002 Paper 1 Q.11

Express in its simplest form

$$y^8 \times (y^3)^{-2}.$$

2	
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(45) 2002 Paper 2 Q.9

Esther has a new mobile phone and considers the following daily rates.

Easy Call

25 pence per minute for
the first 3 minutes

5 pence per minute **after**
the first three minutes

Green Call

40 pence per minute for
the first 2 minutes

2 pence per minute **after**
the first two minutes

- (a) For Easy Call, find the cost of ten minutes in a day.
- (b) For Easy Call, find a formula for the cost of “m” minutes in a day, $m > 3$.
- (c) For Green Call, find a formula for the cost of “m” minutes in a day, $m > 2$.
- (d) Green Call claims that its system is cheaper.
- Find **algebraically** the least number of minutes (to the nearest minute) which must be used each day for this claim to be true.

1	
	1
	1
	3

(46) 2001 Paper 1 Q.3

Given that $f(m) = m^2 - 3m$, evaluate $f(-5)$.

2	
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(47) 2001 Paper 1 Q.4

Solve **algebraically** the equation

$$2x - \frac{(3x-1)}{4} = 4.$$

3	
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(48) 2001 Paper 1 Q.10

Simplify

$$\frac{\sqrt{3}}{\sqrt{24}}.$$

Express your answer as a fraction with a rational denominator.

KU	RE

3	
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(49) 2001 Paper 1 Q.11

The intensity of light, I , emerging after passing through a liquid with concentration, c , is given by the equation

$$I = \frac{20}{2^c} \quad c \geq 0.$$

(a) Find the intensity of light when the concentration is 3.

1	
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(b) Find the concentration of the liquid when the intensity is 10.

2	
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(c) What is the maximum possible intensity?

	3
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(50) 2000 Paper 1 Q.3

$$f(x) = 2x - 5x^2.$$

Find $f(-2)$.

2

(51) 2000 Paper 1 Q.4

(a) Factorise $x^2 - 16$.

1

(b) Express $\frac{5(2x-3)}{4x^2-9}$ in its simplest form.

2

(52) 2000 Paper 1 Q.8

Solve **algebraically** the inequality

$$2y < 3 - (y + 6).$$

3

(53) 2000 Paper 1 Q.9

(a) Remove the brackets and simplify

$$a^{\frac{1}{2}} \left(a + \frac{1}{a} \right).$$

2

(b) Express $\sqrt{18} - \sqrt{2}$ as a surd in its simplest form.

2

(54) 1999 Paper 1 Q.2

Evaluate

$$20 - 4x^2y \text{ where } x = -1 \text{ and } y = 3.$$

2

(55) 1999 Paper 1 Q.4

Factorise $3x^2 - 5x - 2$.

2

(56) 1999 Paper 1 Q.9

Solve **algebraically** the inequality

$$5x - 4 < 2(1 - 2x).$$

3

(57) 1999 Paper 1 Q.10

$$f(x) = 3^x$$

(a) Find $f(4)$.

1

(b) Given that $f(x) = \sqrt{27}$, find x .

3

(58) 1998 Paper 1 Q.2

Evaluate $a^2 + 2ab$ where $a = -5$ and $b = -4$.

2

(59) 1998 Paper 1 Q.3

$$f(x) = \frac{3}{x^2}$$

Find $f\left(\frac{1}{3}\right)$

2

(60) 1998 Paper 1 Q.9

(a) Multiply out the brackets

$$\sqrt{2}(\sqrt{6} - \sqrt{2}).$$

Express your answer as a **surd** in its simplest form.

2

(b) Express $\frac{b^{\frac{1}{2}} \times b^{\frac{3}{2}}}{b}$ in its simplest form.

2