

# High School Mathematics Test 2013

Year  
10A

## Non Linear Equations

Calculator Allowed

### Skills and Knowledge Assessed:

- Graph simple non-linear relations with and without the use of digital technologies and solve simple related equations (ACMNA296)
- Solve simple quadratic equations using a range of strategies (ACMNA241)
- 10 A Solve simple exponential equations (ACMNA270)
- 10A Factorise monic and non-monic quadratic expressions and solve a wide range of quadratic equations derived from a variety of contexts (ACMNA269)

Name \_\_\_\_\_

### Section 1 Short Answer Section

Write all working and answers in the spaces provided on this test paper.

1. Solve the equation  $6x^2 = 54$ .

.....  
.....

2. For what values of  $m$  is  $m^2 - 81 = 0$  ?

.....  
.....

3. For what values of  $e$  is  $e^2 - 45 = 4$  ?

.....  
.....

4. Solve for  $w$ :  $(w - 9)(w + 8) = 0$

.....  
.....

5. Solve  $c^2 + 13c + 40 = 0$

.....  
.....

---

6. Solve the equation:  $p^2 - 3p - 54 = 0$ .

.....  
.....

---

7. For what values of  $k$ , is  $k^2 + k - 42 = 0$  ?

.....  
.....

---

8. Solve  $r^2 - 17r + 72 = 0$

.....  
.....

---

9. Solve  $3a^2 + 35a + 50 = 0$ .

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

---

10. Solve  $2g^2 + 3g - 20 = 0$ .

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

---

11. Solve  $3s^2 - 28s + 32 = 0$ .

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

---

12. Give the exact values for which  $x^2 - 11x - 3 = 0$ .

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

---

- 
13. Find the solutions to  $2x^2 - x - 8 = 0$ , correct to one decimal place.

.....

.....

- 
14. Determine if  $3x^2 - 2x + 6 = 0$ , has any real number solution.

.....

.....

.....

---

# High School Mathematics Test 2013

## Non Linear Equations

Calculator Allowed

Year  
10A

Name \_\_\_\_\_

### Section 2 Multiple Choice Section

Mark all your answers on the accompanying multiple choice answer sheet, not on this test paper. You may do any working out on this test paper. Calculators are allowed for this section.

1. The solutions to  $(x - 4)(x + 7) = 0$  are:

- A.  $x = 4$  or  $x = 7$ .      B.  $x = -4$  or  $x = -7$ .  
C.  $x = 4$  or  $x = -7$ .      D.  $x = -4$  or  $x = 7$ .
- 

2. For what values of  $x$  is  $(3x - 4)(2x + 1) = 0$ ?

- A.  $x = -\frac{3}{4}$  or  $x = \frac{1}{2}$ .      B.  $x = -\frac{4}{3}$  or  $x = \frac{1}{2}$ .  
C.  $x = \frac{3}{4}$  or  $x = -\frac{1}{2}$ .      D.  $x = \frac{4}{3}$  or  $x = -\frac{1}{2}$ .
- 

3. The solutions to  $4x^2 - 25 = 0$  are:

- A.  $x = -\frac{5}{2}$  or  $x = \frac{5}{2}$ .      B.  $x = -\frac{5}{2}$  or  $x = 0$ .  
C.  $x = -\frac{2}{5}$  or  $x = \frac{2}{5}$ .      D.  $x = -\frac{2}{5}$  or  $x = 0$ .
- 

4. For what values of  $m$  is  $m^2 + 18m + 77 = 0$ ?

- A.  $m = -7$  or  $m = -11$ .      B.  $m = -7$  or  $m = 11$ .  
C.  $m = 7$  or  $m = -11$ .      D.  $m = 7$  or  $m = 11$ .
- 

5. The solutions to  $e^2 - 16e + 60 = 0$  are:

- A.  $e = -3$  or  $e = -20$ .      B.  $e = -4$  or  $e = -15$ .  
C.  $e = -5$  or  $e = -12$ .      D.  $e = 6$  or  $e = 10$ .
-

---

6. Solve  $2y^2 - 19y + 35 = 0$ .

A.  $y = -7$  or  $y = -\frac{5}{2}$ .      B.  $y = \frac{5}{2}$  or  $y = 7$ .

C.  $y = \frac{7}{2}$  or  $y = 5$ .      D.  $y = \frac{7}{2}$  or  $y = -5$ .

---

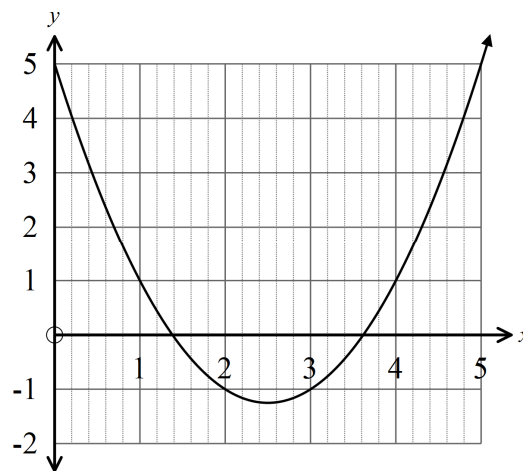
7. The graph of  $y = x^2 - 6x - 10$  is shown.  
Estimate the solution to  $x^2 - 6x - 10 = 0$

A.  $x = -1.2$  or  $x = 4.9$ .

B.  $x = 1.2$  or  $x = 3.3$ .

C.  $x = 1.4$  or  $x = 3.6$ .

D.  $x = 2.4$  or  $x = 4.4$ .



---

8. The solutions to  $3e^2 + 10e + 5 = 0$  are:

A.  $e = \frac{-10 \pm \sqrt{40}}{6}$       B.  $e = \frac{-10 \pm \sqrt{127}}{6}$

C.  $e = \frac{10 \pm \sqrt{40}}{6}$       D.  $e = \frac{10 \pm \sqrt{127}}{6}$

---

9. Solve  $2y^2 + y - 15 = 0$ .

A.  $y = -\frac{5}{2}$  or  $y = -3$ .      B.  $y = \frac{5}{2}$  or  $y = -3$ .

C.  $y = \frac{-1 \pm \sqrt{119}}{6}$       D.  $y = \frac{1 \pm \sqrt{119}}{6}$

---

10. For what value of  $x$  is  $2^x = 16$

A.  $x = 3$ .      B.  $x = 4$ .      C.  $x = 5$ .      D.  $x = 8$ .

---

# High School Mathematics Test 2013

Year  
10A

## Non Linear Equations

Calculator Allowed

Name \_\_\_\_\_

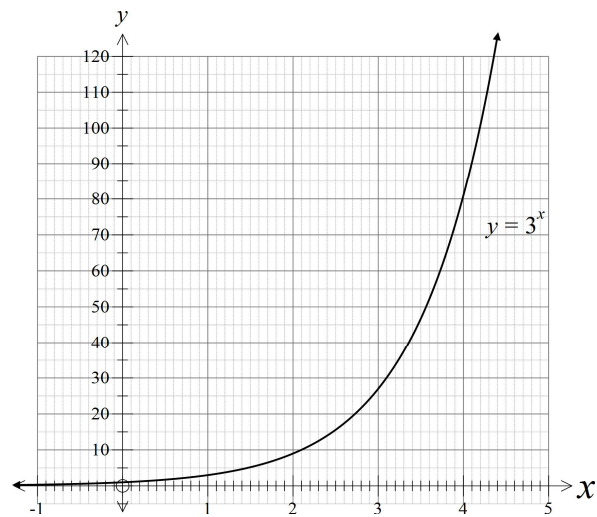
### Section 3 Longer Answer Section

Write all working and answers in the spaces provided on this test paper.

	Marks
1. a) The product of two consecutive odd numbers is 143.	
i) If the first number is $x$ , write an expression for the second number.	1
.....	
ii) Write an equation in terms of $x$ , for the product of the two numbers.	1
.....	
iii) Solve the equation to find the value of $x$ , and hence find the two numbers.	2
.....	
.....	
b) Keith is five years younger than his friend Liam. In five years from now, the product of their ages will be 500.	
i) Using $k$ to represent Keith's current age, write expressions for both of their ages in five years from now.	1
.....	
ii) Write an equation for the product of their ages in five years from now and solve it to find their current ages.	2
.....	
.....	
.....	
.....	

## Marks

2. A sketch of  $y = 3^x$  is shown below.



- i) Solve  $3^x = 50$ .

1

- ii) Solve  $3^x = 110$ .

1

- iii) Solve  $3^x = 10$ .

1

# *High School Mathematics Test 2013*

## *Multiple Choice Answer Sheet*

Name \_\_\_\_\_

Completely fill the response oval representing the most correct answer.

- |     |   |                       |   |                       |   |                       |   |                       |
|-----|---|-----------------------|---|-----------------------|---|-----------------------|---|-----------------------|
| 1.  | A | <input type="radio"/> | B | <input type="radio"/> | C | <input type="radio"/> | D | <input type="radio"/> |
| 2.  | A | <input type="radio"/> | B | <input type="radio"/> | C | <input type="radio"/> | D | <input type="radio"/> |
| 3.  | A | <input type="radio"/> | B | <input type="radio"/> | C | <input type="radio"/> | D | <input type="radio"/> |
| 4.  | A | <input type="radio"/> | B | <input type="radio"/> | C | <input type="radio"/> | D | <input type="radio"/> |
| 5.  | A | <input type="radio"/> | B | <input type="radio"/> | C | <input type="radio"/> | D | <input type="radio"/> |
| 6.  | A | <input type="radio"/> | B | <input type="radio"/> | C | <input type="radio"/> | D | <input type="radio"/> |
| 7.  | A | <input type="radio"/> | B | <input type="radio"/> | C | <input type="radio"/> | D | <input type="radio"/> |
| 8.  | A | <input type="radio"/> | B | <input type="radio"/> | C | <input type="radio"/> | D | <input type="radio"/> |
| 9.  | A | <input type="radio"/> | B | <input type="radio"/> | C | <input type="radio"/> | D | <input type="radio"/> |
| 10. | A | <input type="radio"/> | B | <input type="radio"/> | C | <input type="radio"/> | D | <input type="radio"/> |



# High School Mathematics Test 2013 Non Linear Equations

## ANSWERS

Section 1	
1.	$6x^2 = 54$ $6x^2 - 54 = 0$ $x^2 = 9$ $x = \pm 3$
2.	$6x^2 - 64 = 0$ $6(x + 3)(x - 3) = 0$ $x = \pm 3$
3.	$m^2 - 81 = 0$ $(m + 9)(m - 9) = 0$ $m = \pm 9$
4.	$e^2 - 45 = 4 ?$ $e^2 - 49 = 0$ $(e + 7)(e - 7) = 0$ $e = \pm 7$
5.	$(w - 9)(w + 8) = 0$ $w = 9 \text{ or } w = -8.$
6.	$c^2 + 13c + 40 = 0$ $(c + 5)(c + 8) = 0$ $c = -5 \text{ or } -8$
7.	$p^2 - 3p - 54 = 0$ $(p - 9)(p + 6) = 0$ $p = 9 \text{ or } p = -6$
8.	$k^2 + k - 42 = 0 ?$ $(k + 7)(k - 6) = 0$ $k = -7 \text{ or } k = 6$
9.	$r^2 - 17r + 72 = 0$ $(r - 9)(r - 8) = 0$ $r = 9 \text{ or } r = 8$
10.	$3a^2 + 35a + 50 = 0.$ $3a^2 + 5a + 30a + 50 = 0$ $a(3a + 5) + 10(3a + 5) = 0$ $(3a + 5)(a + 10) = 0$ $a = -\frac{5}{3} \text{ or } a = -10$

10.	$2g^2 + 3g - 20 = 0.$ $2g^2 + 8g - 5g - 20 = 0$ $2g(g + 4) - 5(g + 4) = 0$ $(2g - 5)(g + 4) = 0$ $g = \frac{5}{2} \text{ or } g = -4$
11.	$3s^2 - 28s + 32 = 0.$ $3s^2 - 24s - 4s + 32 = 0$ $3s(s - 8) - 4(s - 8) = 0$ $(3s - 4)(s - 8) = 0$ $s = \frac{4}{3} \text{ or } s = 8$
12.	$x^2 - 11x - 3 = 0.$ <p>Does not factorise, so use formula or complete the square.</p> $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{11 \pm \sqrt{121 - 4(1)(-3)}}{2(1)}$ $= \frac{11 \pm \sqrt{121 + 12}}{2}$ $= \frac{11 \pm \sqrt{133}}{2}$
13.	$2x^2 - x - 8 = 0,$ <p>Does not factorise, so use formula or complete the square.</p> $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{1 \pm \sqrt{1 - 4(2)(-8)}}{2(2)}$ $= \frac{1 \pm \sqrt{1 + 64}}{4}$ $= \frac{1 \pm \sqrt{65}}{4}$ $x = -1.8 \text{ or } x = 2.3$
14.	$3x^2 - 2x + 6 = 0,$ has a solution if the quadratic formula can be evaluated. i.e. if $\sqrt{b^2 - 4ac}$ can be evaluated, which is when $b^2 - 4ac \geq 0$ $b^2 - 4ac = 4 - 4(3)(6)$ $= 4 - 72$ $= -68$ <p>Hence there is no real number solution.</p>

Section 2	
1.	C
2.	D
3.	A
4.	A
5.	D
6.	B
7.	C
8.	A
9.	B
10.	B

Section 3		
1.	<p>i) 2nd number is <math>x + 2</math></p> <p>ii) <math>x(x + 2) = 143</math></p> <p>iii) <math>x(x + 2) = 143</math></p> $x^2 + 2x = 143$ $x^2 + 2x - 143 = 0$ $(x + 13)(x - 11) = 0$ $x = -13 \text{ or } x = 11$ <p><math>x = 11</math> is the only positive result.</p> <p>the numbers are 11 and 13.</p>	<p><b>(1 mark)</b></p> <p><b>(1 mark)</b></p> <p><b>(2 marks)</b></p>
	<p>i) Current ages are <math>k</math> and <math>k + 5</math>. Ages in five years are <math>k + 5</math> and <math>k + 10</math></p> <p>ii) <math>(k + 5)(k + 10) = 500</math></p> $k^2 + 15k + 50 = 500$ $k^2 + 15k - 450 = 0$ $(k + 30)(k - 15) = 0$ $k = -30 \text{ or } k = 15$ <p>Only <math>k = 15</math> can be an age.</p> <p>Their current ages are 15 and 20.</p>	<p><b>(1 mark)</b></p> <p><b>(2 marks)</b></p>
2.	a) $x \approx 3.5$	<b>1</b>
	b) $x \approx 4.3$	<b>1</b>
	c) $x \approx 2.1$	<b>1</b>

# High School Mathematics Test 2013

## Multiple Choice Answer Sheet

Name \_\_\_\_\_ Marking Sheet

Completely fill the response oval representing the most correct answer.

- |     |   |                                  |   |                                  |   |                                  |   |                                  |
|-----|---|----------------------------------|---|----------------------------------|---|----------------------------------|---|----------------------------------|
| 1.  | A | <input type="radio"/>            | B | <input type="radio"/>            | C | <input checked="" type="radio"/> | D | <input type="radio"/>            |
| 2.  | A | <input type="radio"/>            | B | <input type="radio"/>            | C | <input type="radio"/>            | D | <input checked="" type="radio"/> |
| 3.  | A | <input checked="" type="radio"/> | B | <input type="radio"/>            | C | <input type="radio"/>            | D | <input type="radio"/>            |
| 4.  | A | <input checked="" type="radio"/> | B | <input type="radio"/>            | C | <input type="radio"/>            | D | <input type="radio"/>            |
| 5.  | A | <input type="radio"/>            | B | <input type="radio"/>            | C | <input type="radio"/>            | D | <input checked="" type="radio"/> |
| 6.  | A | <input type="radio"/>            | B | <input checked="" type="radio"/> | C | <input type="radio"/>            | D | <input type="radio"/>            |
| 7.  | A | <input type="radio"/>            | B | <input type="radio"/>            | C | <input checked="" type="radio"/> | D | <input type="radio"/>            |
| 8.  | A | <input checked="" type="radio"/> | B | <input type="radio"/>            | C | <input type="radio"/>            | D | <input type="radio"/>            |
| 9.  | A | <input type="radio"/>            | B | <input checked="" type="radio"/> | C | <input type="radio"/>            | D | <input type="radio"/>            |
| 10. | A | <input type="radio"/>            | B | <input checked="" type="radio"/> | C | <input type="radio"/>            | D | <input type="radio"/>            |