High School
Mathematics Test 2014

Year 10A

Non Linear Equations

Non Calculator

- Graph simple nonlinear 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 nonmonic 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. Find the values of x for which $x^2 = 64$.

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2. Solve the equation $5a^2 = 45$.

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3. For what values of m is $m^2 - 36 = 0$?

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4. For what values of p is $p^2 - 21 = 4$?

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5. Solve for w: $2w^2 - 12 = 86$.

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6. Solve $(d + 8)(d - 7) = 0$.

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7. Solve the equation: $s^2 + 15s + 36 = 0$.

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8. For what values of p, is : $p^2 - 6p - 55 = 0$?

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9. Solve $a^2 - 19a + 90 = 0$.

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10. Solve $r^2 + 23r - 50 = 0$.

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11. Solve $2g^2 + 5g - 3 = 0$.

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12. Solve $3s^2 - 8s - 16 = 0$.

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13. Give the exact values for which $x^2 + 7x + 5 = 0$.

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14. Find the solutions to $2x^2 + 6x - 5 = 0$, correct to one decimal place.

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15. Determine if $5x^2 - 7x + 3 = 0$, has any real number solutions, explaining your answer.

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Calculator Allowed

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 $(m-2)(m-5)=0$ are:

   A. $m=-2$ or $m=-5$. B. $m=-2$ or $m=5$.

   C. $m=2$ or $m=-5$. D. $m=2$ or $m=5$.

2. For what values of x is $(2x-5)(3x+4)=0$?

   A. $x=-\frac{5}{2}$ or $x=\frac{4}{3}$. B. $x=-\frac{2}{5}$ or $x=\frac{3}{4}$.

   C. $x=\frac{2}{5}$ or $x=-\frac{3}{4}$. D. $x=\frac{5}{2}$ or $x=-\frac{4}{3}$.

3. The solutions to $9x^2-49=0$ are:

   A. $x=-\frac{7}{3}$ or $x=\frac{7}{3}$. B. $x=-\frac{7}{3}$ only.

   C. $x=-\frac{3}{7}$ or $x=\frac{3}{7}$. D. $x=\frac{7}{3}$ only.

4. For what values of k is $k^2+18k+81=0$?

   A. $k=-9$ or $k=9$. B. $k=-9$ only.

   C. $k=9$ only. D. $k=9$ or $k=0$.

5. The solutions to $e^2-5e-66=0$ are:

   A. $e=-11$ or $e=-6$. B. $e=-11$ or $e=6$.

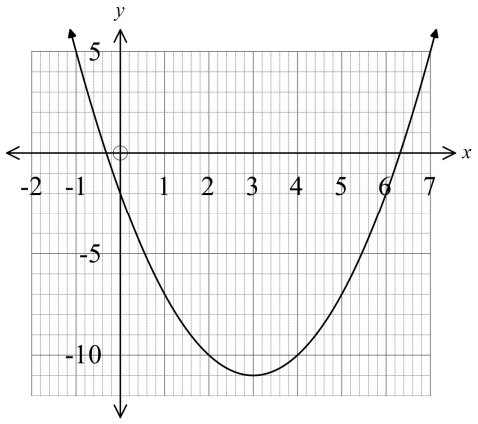
   C. $e=-6$ or $e=11$. D. $e=6$ or $e=11$.

6. Solve $3w^2 + 17w - 28 = 0$.

A. $w = -7$ or $w = -\frac{4}{3}$. B. $w = -7$ or $w = \frac{4}{3}$.

C. $w = 7$ or $w = -\frac{4}{3}$. D. $w = 7$ or $w = \frac{4}{3}$.

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



A. $x = -6.3$ or $x = 0.3$.

B. $x = -2.0$ or $x = -12.0$.

C. $x = -0.3$ or $x = 6.3$.

D. $x = 3.0$ or $x = -12.0$.

8. Find all the solutions to $x(3x - 7) = 10$.

A. $x = -1$ or $x = 3\frac{1}{3}$. B. $x = -1$ or $x = \frac{1}{3}$.

C. $x = 0$ or $x = 2\frac{1}{3}$. D. $x = 1$ or $x = 2\frac{1}{3}$.

9. The solutions to $2e^2 + 7e + 2 = 0$ are:

A. $e = \frac{-7 \pm \sqrt{33}}{4}$ B. $e = \frac{-7 \pm \sqrt{65}}{4}$

C. $e = \frac{7 \pm \sqrt{33}}{4}$ D. $e = \frac{7 \pm \sqrt{65}}{4}$

10. Solve $y^2 + y - 14 = 0$.

A. $y = -4.8$ or 2.8. B. $y = 2.8$ or -4.8

C. $y = 3.3$ or -4.3. D. $y = 4.3$ or -3.3.

11. For what value of x is $x^3 = 27$?

A. $x = 2$. B. $x = 3$. C. $x = 9$. D. $x = 13.5$.

12. Make x the subject of the equation $m = \frac{2x^2 - 4y}{r}$.

A. $x = \pm 2\sqrt{(rm + 4y)}$ B. $x = \pm \frac{\sqrt{rm + 4y}}{2}$ C. $x = \pm\sqrt{\frac{rm - 4y}{2}}$ D. $x = \pm\sqrt{\frac{rm + 4y}{2}}$

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Section 3 Longer Answer Section

Answers should be supported by relevant mathematical reasoning and/or calculations.
Write all working and answers in the spaces provided on this test paper.

Marks

1. (a) Solve $3x(x+1) = x^2 - 2x + 3$. **2**

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(b) Lisa is six years younger than her brother Marty. In two year's time, the product of their ages will be 280.

i) Using m to represent Marty's current age, write expressions for both of their ages in two years time. **1**

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ii) Write an equation for the product of their ages in two years from now and solve it to find their current ages. **3**

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Marks

2. Solve simultaneously **2**

$$\begin{cases} y = 4x - 15 \\ y = x^2 - 4x \end{cases}$$

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Non Linear Equations

Multiple Choice Answer Sheet

Name _____

Completely fill the response oval representing the most correct answer.

1.	A ⬭	B ⬭	C ⬭	D ⬭
2.	A ⬭	B ⬭	C ⬭	D ⬭
3.	A ⬭	B ⬭	C ⬭	D ⬭
4.	A ⬭	B ⬭	C ⬭	D ⬭
5.	A ⬭	B ⬭	C ⬭	D ⬭
6.	A ⬭	B ⬭	C ⬭	D ⬭
7.	A ⬭	B ⬭	C ⬭	D ⬭
8.	A ⬭	B ⬭	C ⬭	D ⬭
9.	A ⬭	B ⬭	C ⬭	D ⬭
10.	A ⬭	B ⬭	C ⬭	D ⬭
11.	A ⬭	B ⬭	C ⬭	D ⬭
12.	A ⬭	B ⬭	C ⬭	D ⬭

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Non Linear Equations

ANSWERS

Section 1 (1 mark each)	
	Working and Answers
1.	$x^2 = 64$ $x = \pm 8$
2.	$5a^2 = 45.$ $a^2 = \frac{45}{5} = 9$ $a = \pm 3$
3.	$m^2 - 36 = 0$ $(m + 6)(m - 6) = 0$ $m = \pm 6$
4.	$p^2 - 21 = 4$ $p^2 - 25 = 0$ $(p + 5)(p - 5) = 0$ $P = \pm 5$
5.	$2w^2 - 12 = 86$ $2w^2 - 98 = 0$ $w^2 - 49 = 0$ $(w + 7)(w - 7) = 0$ $w = \pm 7$
6.	$(d + 8)(d - 7) = 0$ $d + 8 = 0, \quad d - 7 = 0$ $d = -8, \qquad d = 7$
7.	$s^2 + 15s + 36 = 0$ $(s + 12)(s + 3) = 0$ $s = -12, \quad s = -3$
8.	$p^2 - 6p - 55 = 0$ $(p - 11)(p + 5) = 0$ $p = 11, \quad p = -5$
9.	$a^2 - 19a + 90 = 0$ $(a - 10)(a - 9) = 0$ $a = 10, a = 9$

10.	$r^2 + 23r - 50 = 0$ $(r + 25)(r - 2) = 0$ $r = -25, \quad r = 2$
11.	$2g^2 + 5g - 3 = 0$ $2g^2 + 6g - g - 3 = 0$ $(2g - 1)(g + 3) = 0$ $2g - 1 = 0, \quad g + 3 = 0$ $g = \frac{1}{2}, \quad g = -3$
12.	$3s^2 - 8s - 16 = 0$ $3s^2 - 12s + 4s - 16 = 0$ $(3s + 4)(s - 4) = 0$ $3s + 4 = 0, \quad s - 4 = 0$ $s = -\frac{4}{3}, \quad s = 4$
13.	$x^2 + 7x + 5 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $x = \frac{-7 \pm \sqrt{49 - 20}}{2}$ $x = \frac{-7 \pm \sqrt{29}}{2}$
14.	$2x^2 + 6x - 5 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $x = \frac{-6 \pm \sqrt{36 + 40}}{2 \times 2}$ $x = \frac{-6 \pm \sqrt{76}}{4}$ $x = 0.6794494, \quad \text{or} \quad x = -3.679449$ $x = 0.68 \quad \text{or} \quad x = -3.68$
15.	$5x^2 - 7x + 3 = 0$ has real number solutions if $b^2 - 4ac \geq 0$ $b^2 - 4ac = (-7)^2 - 4 \times 5 \times 3$ $= 49 - 60$ $= -11$ $\therefore \quad b^2 - 4ac < 0$ $\therefore$ no real solutions

Section 2 (1 mark each)		
	Working	Answers
1.	$(m-2)(m-5)=0$ $m=2,\quad m=5$	D
2.	$(2x-5)(3x+4)=0$ $2x-5=0,\quad 3x+4=0$ $2x=5,\quad 3x=-4$ $x=\frac{5}{2},\quad x=-\frac{4}{3}$	D
3.	$9x^2-49=0$ $(3x+7)(3x-7)=0$ $x=-\frac{7}{3},\ x=\frac{7}{3}$	A
4.	$k^2+18k+81=0$ $(k+9)^2=0$ $k=-9$	B
5.	$e^2-5e-66=0$ $(e-11)(e+6)=0$ $e=11$ or $e=-6$	C
6.	$3w^2+17w-28=0$ $3w^2+21w-4w-28=0$ $3w(w+7)-4(w+7)=0$ $(3w-4)(w+7)=0$ $3w=4$ or $w=-7$ $w=\frac{4}{3}$ or $w=-7$	B
7.	$x=6.3$ or -0.3 (from graph)	C
8.	$x(3x-7)=10$ $3x^2-7x=10$ $3x^2-7x-10=0$ $3x^2+3x-10x-10=0$ $3x(x+1)-10(x+1)=0$ $(3x-10)(x+1)=0$ $3x=10$ or $x=-1$ $x=\frac{10}{3}$ or $x=-1$ $x=3\frac{1}{3}$ or $x=-1$	A

9.	$2e^2 + 7e + 2 = 0$ $e = \frac{-7 \pm \sqrt{49 - 4 \times 2 \times 2}}{2 \times 2}$ $= \frac{-7 \pm \sqrt{33}}{4}$	A
10.	$y^2 + y - 14 = 0$ $y = \frac{-1 \pm \sqrt{1 - 4 \times 1 \times (-14)}}{2 \times 1}$ $= \frac{-1 \pm \sqrt{57}}{2}$ $= 3.3$ or -4.3	C
11.	$3^x = 27$ $3^3 = 27$ $\therefore \quad x = 3$	B
12.	$m = \frac{2x^2 - 4y}{r}$ $rm = 2x^2 - 4y$ $rm + 4y = 2x^2$ $x^2 = \frac{rm + 4y}{2}$ $x = \pm\sqrt{\frac{rm + 4y}{2}}$	D

Section 3		
	Working and Answers	Marks
1.	a) $3x(x + 1) = x^2 - 2x + 3$ $3x^2 + 3x = x^2 - 2x + 3$ $2x^2 + 5x - 3 = 0$ $2x^2 + 6x - x - 3 = 0$ $(2x - 1)(x + 3) = 0$ $x = \frac{1}{2}$ or $x = -3$	1 for expanding and simplifying 1 for solving

	b) i) m = Marty's age now $m - 6$ = Lisa's age now $m + 2$ = Marty's age in 2 years $m - 6 + 2 = m - 4$ = Lisa's age in 2 years ii) $(m + 2)(m - 4) = 280$ $m^2 - 2m - 8 = 280$ $m^2 - 2m - 288 = 0$ $(m + 16)(m - 18) = 0$ $m = -16$ or $m = 18$ Only use $m = 18$ Ages are 18 and $18 - 6 = 12$.	1 for both correct 1 for equation 2 for solution
2.	$y = 4x - 15$ ① $y = x^2 - 4x$ ② Sub ① into ② $4x - 15 = x^2 - 4x$ $x^2 - 8x + 15 = 0$ $(x - 5)(x - 3) = 0$ $x = 3$ or $x = 5$ $y = -3$ or $y = 5$	1 for substituting and simplifying 1 for solving

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Multiple Choice Answer Sheet

Name __Marking Sheet

Completely fill the response oval representing the most correct answer.

1.	A ○	B ○	C ○	D ●
2.	A ○	B ○	C ○	D ●
3.	A ●	B ○	C ○	D ○
4.	A ○	B ●	C ○	D ○
5.	A ○	B ○	C ●	D ○
6.	A ○	B ●	C ○	D ○
7.	A ○	B ○	C ●	D ○
8.	A ●	B ○	C ○	D ○
9.	A ●	B ○	C ○	D ○
10.	A ○	B ○	C ●	D ○
11.	A ○	B ●	C ○	D ○
12.	A ○	B ○	C ○	D ●