

Name: _____

Exam Style Questions
Simultaneous Equations
Linear and Non-linear



Corbettmaths

Equipment needed: Pen, Calculator

Guidance

1. Read each question carefully before you begin answering it.
2. Check your answers seem right.
3. Always show your workings

Video Tutorial

www.corbettmaths.com/contents

Video 298



Answers and Video Solutions



1. Solve the equations



$$x^2 + y^2 = 20$$

$$x + y = 6$$

$$x = 6 - y$$

$$(6 - y)^2 + y^2 = 20$$

$$(6 - y)(6 - y) + y^2 = 20$$

$$36 - 12y + y^2 + y^2 = 20$$

$$2y^2 - 12y + 16 = 0$$

$$y^2 - 6y + 8 = 0$$

$$(y - 2)(y - 4) = 0$$

$$y = 2 \quad y = 4$$

$$\text{when } y = 2, x = 4$$

$$\text{when } y = 4, x = 2$$

$$x = 2 \text{ and } y = 4$$

$$\text{or } x = 4 \text{ and } y = 2$$

(4)

2. Solve the equations



$$xy = 24$$

$$x = y - 2$$

$$(y - 2)y = 24$$

$$y^2 - 2y = 24$$

$$y^2 - 2y - 24 = 0$$

$$(y - 6)(y + 4) = 0$$

$$y = 6 \text{ or } y = -4$$

$$\text{when } y = 6$$

$$x = 6 - 2$$

$$x = 4$$

$$\text{when } y = -4$$

$$x = -4 - 2$$

$$= -6$$

$$x = 4 \text{ and } y = 6$$

$$\text{or } x = -6 \text{ and } y = -4$$

(4)

3. Solve the simultaneous equations



$$2x - y = 7$$

$$xy = 15$$

$$2x = y + 7$$

$$y = 2x - 7$$

$$x(2x - 7) = 15$$

$$2x^2 - 7x - 15 = 0$$

$$(2x + 3)(x - 5) = 0$$

$$2x + 3 = 0 \quad \text{or} \quad x = 5$$

$$2x = -3$$

$$x = -1.5$$

$$\text{when } x = 5$$

$$2x - y = 7$$

$$10 - y = 7$$

$$y = 3$$

$$\text{when } x = -1.5$$

$$2x - y = 7$$

$$-3 - y = 7$$

$$y = -10$$

$$x = 5 \text{ and } y = 3$$

or

$$x = -1.5 \text{ and } y = -10$$

(4)

4. Solve the equations



$$x^2 + y^2 = 17$$

$$x + 4y = 0$$

$$x = -4y$$

$$(-4y)^2 + y^2 = 17$$

$$16y^2 + y^2 = 17$$

$$17y^2 = 17$$

$$y^2 = 1$$

$$y = 1 \text{ or } y = -1$$

$$\text{when } y = 1$$

$$x + 4 = 0$$

$$x = -4$$

$$\text{when } y = -1$$

$$x - 4 = 0$$

$$x = 4$$

$$x = -4 \text{ and } y = 1$$

or

$$x = 4 \text{ and } y = -1$$

(4)

5. Solve the equations



$$x + 2y = 3$$

$$x^2 + 3xy = 10$$

$$x = 3 - 2y$$

$$(3 - 2y)^2 + 3(3 - 2y)y = 10$$

$$(3 - 2y)(3 - 2y) + 3y(3 - 2y) = 10$$

$$9 - 12y + 4y^2 + 9y - 6y^2 = 10$$

$$-2y^2 - 3y + 9 = 10$$

$$-2y^2 - 3y - 1 = 0$$

$$2y^2 + 3y + 1 = 0$$

$$(2y + 1)(y + 1) = 0$$

$$y = -0.5 \quad \text{or} \quad y = -1$$

$$\text{when } y = -0.5 \\ x = 4$$

$$\text{when } y = -1 \\ x = 5$$

$$x = 4 \text{ and } y = -0.5$$

$$\text{or } x = 5 \text{ and } y = -1$$

(4)

6. Solve the equations



$$2x + y = 11$$

$$2x^2 - y^2 = 23$$

$$y = 11 - 2x$$

$$2x^2 - (11 - 2x)^2 = 23$$

$$2x^2 - (121 - 44x + 4x^2) = 23$$

$$-2x^2 + 44x - 121 = 23$$

$$-2x^2 + 44x - 144 = 0$$

$$2x^2 - 44x + 144 = 0$$

$$x^2 - 22x + 72 = 0$$

$$(x - 4)(x - 18) = 0$$

$$x = 4 \quad \text{or} \quad x = 18$$

$$x = 4$$

$$8 + y = 11$$

$$y = 3$$

$$x = 18$$

$$36 + y = 11$$

$$y = -25$$

$$x = 4 \text{ and } y = 3$$

or

$$x = 18 \text{ and } y = -25$$

(4)

7. Solve the equations



$$x^2 + y^2 = 25$$

$$x + y = 7$$

$$x = 7 - y$$

$$(7 - y)^2 + y^2 = 25$$

$$49 - 14y + y^2 + y^2 = 25$$

$$2y^2 - 14y + 24 = 0$$

$$y^2 - 7y + 12 = 0$$

$$(y - 3)(y - 4) = 0$$

$$y = 3 \text{ or } y = 4$$

$$\text{when } y = 3$$

$$x = 4$$

$$\text{or when } y = 4$$

$$x = 3$$

$$x = 4 \text{ and } y = 3$$

$$\text{or } x = 3 \text{ and } y = 4$$

(5)

8. Find the coordinates of the points where the line $y = 2x - 2$ and the curve $y = x^2 - 5$ intersect.



$$x^2 - 5 = 2x - 2$$

$$x^2 - 2x - 3 = 0$$

$$(x - 3)(x + 1) = 0$$

$$x = 3 \text{ or } x = -1$$

$$\text{when } x = 3 \quad y = 6 - 2$$

$$y = 4$$

$$\text{when } x = -1 \quad y = -4$$

$$(3, 4) \text{ and } (-1, -4)$$

(5)

9. Solve the equations



$$x^2 - y^2 = 7$$

$$2y = 2 + x$$

$$x = 2y - 2$$

$$(2y - 2)^2 - y^2 = 7$$

$$(2y - 2)(2y - 2) - y^2 = 7$$

$$4y^2 - 8y + 4 - y^2 = 7$$

$$3y^2 - 8y - 3 = 0$$

$$(3y + 1)(y - 3) = 0$$

$$y = -\frac{1}{3} \text{ or } y = 3$$

$$y = 3$$

$$6 = 2 + x$$

$$x = 4$$

$$y = -\frac{1}{3}$$

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

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

$$x = 4, y = 3$$

$$\text{or } x = -2\frac{2}{3}, y = -\frac{1}{3}$$

(5)

10. How many points of intersection does the circle $x^2 + y^2 = 18$ have with the line $x + y = 6$?



$$x^2 + y^2 = 18$$

$$x = 6 - y$$

$$(6 - y)^2 + y^2 = 18$$

$$36 - 12y + y^2 + y^2 = 18$$

$$18 - 12y + 2y^2 = 0$$

$$9 - 6y + y^2 = 0$$

$$y^2 - 6y + 9 = 0$$

$$(y - 3)(y - 3) = 0$$

$$y = 3$$

$$y = 3$$

$$x = 3$$

only (3, 3)

(5)

11. Solve the equations



$$x^2 + y^2 = 45$$

$$5x - 3y = 21$$

Give your answers to 1 decimal place.

$$5x = 3y + 21$$

$$3y = 5x - 21$$

$$y = \frac{5}{3}x - 7$$

$$x^2 + \left(\frac{5}{3}x - 7\right)^2 = 45$$

$$x^2 + \left(\frac{5}{3}x - 7\right)\left(\frac{5}{3}x - 7\right) = 45$$

$$x^2 + \frac{25}{9}x^2 - \frac{35}{3}x - \frac{35}{3}x + 49 = 45$$

$$\frac{34}{9}x^2 - \frac{70}{3}x + 4 = 0 \quad \times 9$$

$$34x^2 - 210x + 36 = 0 \quad \div 2$$

$$17x^2 - 105x + 18 = 0$$

$$a = 17$$

$$b = -105$$

$$c = 18$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{105 \pm \sqrt{11025 - 1224}}{34}$$

$$x = \frac{105 \pm 99}{34}$$

$$x = 6 \quad \text{or} \quad x = 0.176 \dots$$

$$y = \frac{5}{3}x - 7$$

$$\text{when } x = 6$$

$$y = 3$$

$$\text{when } x = 0.176 \dots$$

$$y = -6.7 \dots$$

$$x = 0.2 \text{ e } y = -6.7$$

$$\text{or } x = 6 \text{ e } y = 3$$

(5)

12. Find the coordinates of the points where the line $y = 3x - 3$ and the curve $y = 2x^2 - 8x + 2$ intersect.



$$2x^2 - 8x + 2 = 3x - 3$$

$$2x^2 - 11x + 5 = 0$$

$$(2x - 1)(x - 5) = 0$$

$$x = \frac{1}{2} \quad \text{or} \quad x = 5$$

$$y = 3x - 3$$

$$\text{When } x = \frac{1}{2}$$

$$y = -1.5$$

$$\text{When } x = 5$$

$$y = 12$$

$$\left(\frac{1}{2}, -\frac{3}{2}\right) \text{ and } (5, 12)$$

(5)

13. Solve the equations



$$y = 3x^2 + 8x - 9$$

$$2x + y = 15$$

Give your answers to 1 decimal place.

$$2x + 3x^2 + 8x - 9 = 15$$

$$3x^2 + 10x - 24 = 0$$

$$a = 3 \quad b = 10 \quad c = -24$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-10 \pm \sqrt{100 - (-288)}}{6}$$

$$x = \frac{-10 \pm \sqrt{388}}{6}$$

$$x = \frac{-10 + \sqrt{388}}{6} \quad \text{or} \quad x = \frac{-10 - \sqrt{388}}{6}$$

$$x = 1.616 \dots$$

$$x = 1.6$$

$$x = -4.949 \dots$$

$$x = -4.9$$

$$x = 1.6 \quad \text{and} \quad y = 11.8$$

or

$$x = -4.9 \quad \text{and} \quad y = 24.9$$

(5)

$$y = 15 - 2x$$

$$\text{when } x = 1.616 \dots$$

$$y = 11.767 \dots$$

$$\text{when } x = -4.94 \dots$$

$$y = 24.899 \dots$$