

# 2nd Year Maths Mr Downes Christmas Test Solutions

## Junior Cycle Higher Level Maths

Wednesday 26 November 2025    1:15 – 3:15

1. Work out the values

a) Evaluate

$$19 - 3k^2 \quad , \quad k = -2.$$

$$\begin{aligned} 19 - 3(-2)^2 &= 19 - 3(4) = \\ 19 - 12 &= 7 \end{aligned}$$

b) Evaluate

$$\frac{30}{2m+3} \quad , \quad m = 6.$$

$$\frac{30}{2(6)+3} = \frac{30}{12+3} = \frac{30}{15} = 2$$

c) Evaluate

$$(3x - 1)^2 \quad , \quad x = 7.$$

$$\begin{aligned} (3(7) - 1)^2 &= (21 - 1)^2 = \\ 20^2 &= 400 \end{aligned}$$

d) Evaluate

$$4y^3 - y + 6 \quad , \quad y = -11.$$

$$\begin{aligned} 4(-11)^3 - (-11) + 6 &= 4(-1331) + \\ 11 + 6 &= -5324 + 17 = -5307 \end{aligned}$$

e) Evaluate

$$\sqrt{p^2 + 24} \quad , \quad p = 7$$

$$\begin{aligned} \sqrt{7^2 + 24} &= \sqrt{49 + 24} = \sqrt{73} \approx \\ 8.544 & \end{aligned}$$

f) Evaluate

$$t^3 - 342 \quad , \quad t = 7.$$

2. Simplify

a) Simplify . Is it a square?

$$1 + 3 + 5 + 7 + 9 + 11 + 13$$

$$49, \text{ Yes, perfect square } (7^2)$$

b) Simplify to a monomial in x

$$4x + 2x + 3x$$

c) Simplify to a linear expression

$$7x + 3 + 2x + 5$$

$$9x + 8$$

d) Simplify to a quadratic trinomial

$$3x^2 + 4x + 5 + 6x^2 + 7x + 8$$

$$9x^2 + 11x + 13$$

e)

$$9x^2 + 8x + 8x^2 + 2x + 8$$

$$4x(5x + 4) - 3(x - 2).$$

g) Multiply out and simplify

$$4x(5x^2 + 4x + 2) - 3(x^2 - 2x + 1).$$

$$\begin{aligned} 20x^3 + 16x^2 + 8x - 3x^2 + 6x - \\ 3 = 20x^3 + 13x^2 + 14x - 3 \end{aligned}$$

h) Simplify

$$\frac{12x^3 + 30x^2 + 15x + 123}{3}.$$

$$4x^3 + 10x^2 + 5x + 41$$

f) Multiply out and simplify

$$\begin{aligned} 20x^2 + 16x - 3x + 6 &= 20x^2 + \\ 13x + 6 & \end{aligned}$$

3. Solve

a)

$$5x = 35$$

$$x = 7$$

b)

$$x + 10 = 50$$

$$x = 40$$

c)

$$7x - 4 = 6x + 5$$

$$7x - 6x = 5 + 4, x = 9$$

d)

$$3x - 4 = 2x + 8 + 6x + 5$$

$$\begin{aligned} 3x - 4 &= 8x + 13, 3x - 8x = \\ 13 + 4, -5x &= 17, x = -\frac{17}{5} \end{aligned}$$

e)

$$6x - 8 - x + 4 = 3x + 4 - 3x + 7$$

$$5x - 4 = 11, 5x = 15, x = 3$$

f)

$$7(3x + 5) = 3x + 4 + 5(2x - 11)$$

$$\begin{aligned} 21x + 35 &= 3x + 4 + 10x - 55, \\ 21x + 35 &= 13x - 51, 8x = \\ -86, x &= -\frac{43}{4} \end{aligned}$$

4. Use the factor method to solve these 4 types of quadratic equation

a) Factor, solve and sketch.

$$x^2 + 7x + 10 = 0.$$

$$(x + 2)(x + 5) = 0, x = -2 \text{ or } x = -5$$

c) Factor, solve and sketch. :

$$x^2 + 2x - 15 = 0.$$

$$(x + 5)(x - 3) = 0, x = -5 \text{ or } x = 3$$

b) Factor, solve and sketch.

$$x^2 - 18x + 77 = 0.$$

$$(x - 7)(x - 11) = 0, x = 7 \text{ or } x = 11$$

d) Factor, solve and sketch.

$$x^2 - x - 90 = 0.$$

$$(x - 10)(x + 9) = 0, x = 10 \text{ or } x = -9$$

5. Solve the following quadratic equations using the quadratic equation

a)

$$2x^2 - 3x - 1 = 0.$$

$$x = \frac{3 \pm \sqrt{9+8}}{4} = \frac{3 \pm \sqrt{17}}{4}, x \approx 1.78 \text{ or } x \approx -0.28$$

c)

$$x^2 - 4x - 2 = 0.$$

$$x = \frac{4 \pm \sqrt{16+8}}{2} = \frac{4 \pm \sqrt{24}}{2} = \frac{4 \pm 2\sqrt{6}}{2} = 2 \pm \sqrt{6}, x \approx 4.45 \text{ or } x \approx -0.45$$

b)

$$3x^2 - 5x + 1 = 0.$$

$$x = \frac{5 \pm \sqrt{25-12}}{6} = \frac{5 \pm \sqrt{13}}{6}, x \approx 1.43 \text{ or } x \approx 0.23$$

d)

$$2x^2 + x - 7 = 0.$$

$$x = \frac{-1 \pm \sqrt{1+56}}{4} = \frac{-1 \pm \sqrt{57}}{4}, x \approx 1.64 \text{ or } x \approx -2.14$$

6. Solve this Simultaneous Equation. In other words find the common point to the two lines.

a)

$$6x + 7y = 64$$

$$5x - 7y = 2$$

Add equations:  $11x = 66, x = 6$ , Substitute:  
 $6(6) + 7y = 64, 36 + 7y = 64, 7y = 28, y = 4$ ,  
 Solution:  $(6, 4)$

b)

$$2x + 3y = 5$$

$$2x - 3y = 11$$

Add equations:  $4x = 16, x = 4$ , Substitute:  
 $2(4) + 3y = 5, 8 + 3y = 5, 3y = -3, y = -1$ ,  
 Solution:  $(4, -1)$

7. Expand these brackets. Use any method you like.

a)

$$(3x + 7)(4x + 11)$$

$$12x^2 + 33x + 28x + 77 = 12x^2 + 61x + 77$$

b)

$$(x - 11)(x + 4)$$

$$x^2 + 4x - 11x - 44 = x^2 - 7x - 44$$

c)

$$(x + 8)(x - 3)$$

$$x^2 - 3x + 8x - 24 = x^2 + 5x - 24$$

d)

$$(7x - 2)(3x + 5)$$

$$21x^2 + 35x - 6x - 10 = 21x^2 + 29x - 10$$