Warm-up Maths Questions for A-level Physics (algebra)

VideoPlato Academy

BASIC ALGEBRA

1. Simplify: 3x+5x

$$3x + 5x = 8x$$

2. Solve for x: 2x+7=15

$$2x = 15 - 7 = 8$$
$$x = 8/2 \quad = 4$$

3. Factorize: x^2-9

[this is a square minus a square – you should learn to recognise these]

$$x^2 - 9 = (x - 3)(x + 3)$$

4. Simplify: 4(x−2) + 3x

$$4(x - 2) + 3 \quad = \quad 4x - 8 + 3x$$
$$= 7x - 8$$

5. Solve for x: 5(x−3)=2x+6

$$5x - 15 = 2x + 6$$
$$5x - 2x = 6 + 15$$
$$3x = 21$$
$$X = 21/3 \quad = 7$$

INTERMEDIATE ALGEBRA

6. Solve for x: $\frac{3x+2}{4} = 5$

$3x + 2 = 20$

$3x = 20 - 2 = 18$ $x = 18/3$ $= 6$

7. Expand: $(2x-3)(x+4)$

$2x^2 + 8x - 3x - 12$ $= 2x^2 + 5x - 12$

8. Solve for x: $x^2 - 5x + 6 = 0$

[quadratic equations may not come up with your exam board, but solving them is a useful skill – check with your teacher]

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$ *where: a=1, b=-5, & c=6*

Either: $x = \frac{5 + \sqrt{5^2 - 24}}{2}$ *so x = 3*   *or* $x = \frac{5 - \sqrt{5^2 - 24}}{2}$ *so x = 2*

9. Factorize: $2x^2 - 8x$

$x(2x - 8)$

10.   Simplify: $\frac{2x^2 - 4x}{x}$

$2x - 4$

ADVANCED ALGEBRA

11.   Solve for x: $\frac{x+3}{x-2} = 2$

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x + 3 = 2x − 4

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x = 7

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12.   Simplify: $\frac{3x^2-2x+1}{x} + 5x$

= 3x - 2 + 1/x + 5x

= 8x - 2 + 1/x

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13.   Solve for x: $3^{2x} = 81$

[for this we use the fact that: $a^{2x} = (a^2)^x$]

$3^{2x} = (3^2)^x = 9^x$

Therefore: $9^x = 81$ $= 9^2$ and so x = 2

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14.   Solve for x: $x^2 - 4x - 12 = 0$

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ *where: a=1, b=-4, & c=-12*

Either: $x = \frac{4 + \sqrt{16 + 48}}{2}$ *= 12/2   = 6   or:* $x = \frac{4 - \sqrt{16 + 48}}{2}$ *= -4/2   = -2*

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15.   Simplify: $\frac{(x^2-1)(x+2)}{x+1}$

[(x^2-1) is a square minus a square and so it equals (x − 1)(x + 1)]

$\frac{(x-1)(x+1)(x+2)}{(x+1)}$ *= (x -1) (x + 2)*

COMPLEX ALGEBRA

16. Solve for x: $\frac{(2x+1)}{x-2} = 3/2$

2x + 1 = (3x − 6) / 2
4x + 2 = 3x − 6　　　　　　　*x = -8*

17. Solve for x: $\log_2(x+3)=4$

[in this question we use the idea that if: $\log_a x = b$　　then: $x = a^b$　(very useful to learn for data analysis questions)]

$2^4 = x + 3$
16 − 3 = x　　　　*x = 13*

18. Solve for x: $x^3 − 3x^2 − 4x + 12 = 0$

Factorise to get:　　(x - 3) (x² − 4) = 0　　square minus a square so: (x − 3) (x + 2)(x − 2) = 0
Either: x - 3 = 0 ∴ x = 3　　　or: x + 2 = 0 ∴ x = -2　　　or: x − 2 = 0 ∴ x = 2

19. Solve the equation: $\frac{(3x+5)}{x^2-4x-12} = \frac{2}{x-6}$

[** looking at this equation we can assume that the denominator x − 6 cannot be zero and therefore x ≠ 6]

(3x + 5)(x − 6) = 2x² − 8x – 24　　and so: x² − 5x -6 = 0
From the quadratic formula: $x = (5 + \sqrt{49}) / 2 = 6^{**}$　or:　$x = (5 - \sqrt{49}) / 2 = -1$ (the only possible answer)

20. Simplify: $\frac{(x^2+6x+8)}{x^2+3x+2} \div \frac{(x^2-2x-8)}{x^2+5x+6}$

$= \frac{(x^2 + 6x + 8)(x^2 + 5x + 6)}{(x^2 + 3x + 2)(x^2 - 2x - 8)}$
$= \frac{(x + 2)(x + 4)(x + 3)(x + 2)}{(x + 2)(x + 1)(x + 2)(x - 4)}$
$= \frac{(x + 4)(x + 3)}{(x + 1)(x - 4)}$