

YEAR 10 Advanced - Class Test 1

QUESTION 1

Factorize

(a) $x^2 - 9x + 20$

(b) $6 + 5x - x^2$

(c) $x^3 + 5x^2 - 6x$

(d) $8x^2 + 11x - 10$

Simplify

(e) $\frac{x^2 - 10x - 24}{x^2 - 4}$

QUESTION 2

Solve for x:

(leave any non rational answers in surd form)

(a) $6x - x^2 = 0$

(b) $(x - 3)^2 = 16$

(c) $x^3 = 9x$

Question 2 - continued – (Solve for x:)

(d) $3x^2 - 24x = 60$

(e) $5x^2 - 8x + 2 = 0$

QUESTION 3

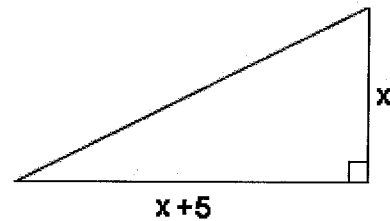
Solve the following by using the "completing the square" method.

(a) $x^2 - 10x = -7$

(b) $2x^2 - 10x + 5 = 0$

QUESTION 4

- (a) The area of the triangle below is known to be 12 cm^2



Find the size of x and hence the length of the hypotenuse to the nearest mm.

Question 4 – Continued

- (b) The height of a ball above the ground, thrown vertically upwards is given by:

$$h = 30t - 5t^2$$

- (i) Find the time, t , elapsed before the ball reaches a height of 40 metres

- (ii) Find how long before the ball falls back to the ground.

QUESTION 5

- (a) Factorize fully: $x^4 - 5x^2 - 36$

- (b) Factorize fully: $a^4 - a^2b^2 + ab^2 - a^3$

- (c) If $x^2 - 8x + 7 = (x + a)^2 + b$
find the values of a and b

- (d) Simplify $\frac{x^5 - x^3}{x^5 + x^4}$

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*✓ Good work!
Check the corrections*

QUESTION 1

Factorize

(a) $x^2 - 9x + 20$

$(x-5)(x-4) ✓$

(b) $6 + 5x - x^2$

$-(x^2 - 5x - 6) ✓$

$-(x-6)(x+1) ✓$

$= (6-x)(x+1)$

(c) $x^3 + 5x^2 - 6x$

$x(x^2 + 5x - 6)$

$x(x+6)(x-1) ✓$

(d) $8x^2 + 11x - 10$

$\begin{array}{r} 8x - 5 \\ \cdot \quad \quad \quad \cdot \\ \hline 1 \quad \quad \quad +2 \end{array}$

$(8x-5)(x+2) ✓$

Simplify

(e) $\frac{x^2 - 10x - 24}{x^2 - 4}$

$\frac{(x-12)(x+2)}{(x+2)(x-2)} ✓$

$= \frac{x-12}{x-2} ✓$

QUESTION 2

Solve for x:

(leave any non rational answers in surd form)

(a) $6x - x^2 = 0$

$x(6-x) = 0 ✓$

$x = 0 \text{ or } 6 ✓$

(b) $(x-3)^2 = 16$

$x^2 - 6x + 9 = 16$

$x^2 - 6x - 7 = 0$

$(x-7)(x+1) = 0$

$x = 7 \text{ or } -1 ✓$

Quicker to take the square root:

$x - 3 = \pm 4$

$\therefore x = 3 \pm 4$

$= \underline{7 \text{ or } -1}$

(c) $x^3 = 9x$

$x^3 - 9x = 0 ✓$

$x(x^2 - 9) = 0 \Rightarrow x(x+3)(x-3) = 0$

$x = 0 \text{ or } 3, -3 ✓$

Question 2 - continued - (Solve for x:)

(d) $3x^2 - 24x = 60$

$$3x^2 - 24x - 60 = 0$$

$$(3x - 30)(x + 2) = 0 \checkmark$$

$$x = 10 \text{ or } -2 \checkmark$$

(e) $5x^2 - 8x + 2 = 0$

$$x = \frac{8 \pm \sqrt{64 - 40}}{10}$$

$$x = \frac{8 \pm \sqrt{24}}{10} \checkmark$$

$$x = \frac{8 + \sqrt{24}}{10} \text{ or } \frac{8 - \sqrt{24}}{10} \checkmark$$

$$= \frac{8 \pm 2\sqrt{6}}{10} = \frac{4 \pm \sqrt{6}}{5}$$

QUESTION 3

Solve the following by using the "completing the square" method.

(a) $x^2 - 10x = -7$

$$x^2 - 10x + 25 = 18 \checkmark$$

$$(x - 5)^2 = 18$$

$$x - 5 = \pm \sqrt{18}$$

$$x = 5 \pm 3\sqrt{2} \checkmark$$

$$x = 3\sqrt{2} + 5 \text{ or } -3\sqrt{2} + 5 \checkmark$$

(b) $2x^2 - 10x + 5 = 0$

$$2x^2 - 10x = -5 \text{ or } \div 2 \text{ gives}$$

$$2(x^2 - 5x) = -5$$

$$x^2 - 5x = -\frac{5}{2}$$

try again.

$$2(x^2 - 5x + \frac{25}{4}) = -5 + \frac{25}{2}$$

$$2(x - \frac{5}{2})^2 = \frac{1}{2}$$

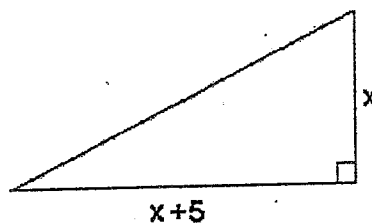
$$(x - \frac{5}{2})^2 = \frac{1}{4}$$

$$x - \frac{5}{2} = \pm \sqrt{\frac{1}{4}}$$

$$x = \pm \sqrt{\frac{1}{4}} + \frac{5}{2} \quad x = \frac{5 \pm \sqrt{1}}{2}$$

QUESTION 4

(a) The area of the triangle below is known to be 12 cm^2



Find the size of x and hence the length of the hypotenuse to the nearest mm.

$$12 = \frac{1}{2}(x+5)x$$

$$24 = x(x+5)$$

$$x^2 + 5x = 24 \checkmark$$

$$x^2 + 5x + \frac{25}{4} = 24 + \frac{25}{4} \checkmark$$

$$(x + \frac{5}{2})^2 = \frac{121}{4}$$

$$x + \frac{5}{2} = \pm \frac{11}{2}$$

$$x = \pm \frac{11}{2} - \frac{5}{2}$$

$$x = \frac{11}{2} - \frac{5}{2}$$

$$x = \frac{6}{2} = 3 \checkmark$$

$$8^2 + 3^2 = y^2$$

$$64 + 9 = y^2$$

$$y = \sqrt{73}$$

$$\text{hyp} = \sqrt{73} \checkmark$$

Question 4 - Continued

- (b) The height of a ball above the ground, thrown vertically upwards is given by:

$$h = 30t - 5t^2$$

- (i) Find the time, t , elapsed before the ball reaches a height of 40 metres

$$40 = 30t - 5t^2$$

Always simplify first i.e.

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

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

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

$$t = \frac{-30 \pm \sqrt{900 - 800}}{-10}$$

$$t = \frac{-30 \pm \sqrt{100}}{-10}$$

$$t = 2 \text{ or } 4 \checkmark$$

- (ii) Find how long before the ball falls back to the ground.

Mid point = 3

sub 3 into t

$$30 \times 3 - 5 \times 9$$

$$h = 45 \checkmark$$

$$-5t^2 + 30t - 45$$

$$t = \frac{-30 \pm \sqrt{900 - 900}}{-10}$$

$$= 3 \checkmark$$

Time it takes the ball to reach the ground is $6 - 2 = 4s$.

QUESTION 5

- (a) Factorize fully: $x^4 - 5x^2 - 36$

$$(x^2 - 9)(x^2 + 4) \checkmark$$

$$= (x+3)(x-3)(x^2+4)$$

- (b) Factorize fully: $a^4 - a^2b^2 + ab^2 - a^3$

$$a^3(a-1) - ab^2(a-1) \checkmark$$

$$= (a^3 - ab^2)(a-1)$$

$$= a(a^2 - b^2)(a-1)$$

$$= a(a-b)(a+b)(a-1) \checkmark$$

- (c) If $x^2 - 8x + 7 = (x+a)^2 + b$ find the values of a and b

$$x^2 - 8x + 16 + 7 = (x+a)^2 + b + 16$$

$$(x-4)^2 + 7 = (x+a)^2 + b + 16 \checkmark$$

$$a = -4 \checkmark$$

$$b = -9 \checkmark$$

- (d) Simplify $\frac{x^5 - x^3}{x^5 + x^4}$

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

$$= \frac{x^3(x-1)}{x^4} \checkmark$$

$$= \frac{(x-1)}{x} \checkmark$$