

Factor theorem + using FT to factorise/solve cubic equations

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Worked example

Show that $(x - 3)$ is a factor of
 $x^3 - 2x^2 - 5x + 6$

Your turn

Show that $(x - 2)$ is a factor of
 $x^3 + x^2 - 4x - 4$

Shown

Worked example

Given that $x + 2$ is a factor of $3x^4 - 4x^2 + a$, find the value of a .

Your turn

Given that $x + 1$ is a factor of $4x^4 - 3x^2 + a$, find the value of a .

$$a = -1$$

Worked example

Given that $2x - 1$ is a factor of $2x^3 + 3x^2 + ax + 11$, find the value of a .

Your turn

Given that $3x - 1$ is a factor of $3x^3 + 11x^2 + ax + 1$, find the value of a .

$$a = -7$$

Worked example

Fully factorise $3x^3 + x^2 - 12x - 4$

Your turn

Fully factorise $2x^3 + x^2 - 18x - 9$

$$(x - 3)(2x + 1)(x + 3)$$

Worked example

$$f(x) = 6x^3 + 11x^2 - 46x + 24$$

Show that $(3x - 2)$ is a factor of $f(x)$ and hence find all the real roots of the equation $f(x) = 0$

Your turn

$$f(x) = 12x^3 - 14x^2 - 61x + 60$$

Show that $(2x - 3)$ is a factor of $f(x)$ and hence find all the real roots of the equation $f(x) = 0$

$$x = -\frac{5}{2}, x = \frac{3}{2}, x = \frac{4}{3}$$

Worked example

Show that $(x - 2)$ is a factor of

$$5x^4 - 16x^3 - 47x^2 + 130x - 24$$

and hence find all the real solutions to

$$5x^4 - 16x^3 - 47x^2 + 130x - 24 = 0$$

Your turn

Show that $(x - 3)$ is a factor of

$$4x^4 + 15x^3 - 48x^2 - 109x + 30$$

and hence find all the real solutions to

$$4x^4 + 15x^3 - 48x^2 - 109x + 30 = 0$$

$$x = -5, x = -2, x = \frac{1}{3}, x = 3$$

Worked example

- a) Use the factor theorem to show that $(x + 1)$ and $(x + 4)$ are factors of $x^3 - 21x - 20$
- b) Given that $(x + 1)$ and $(x + 4)$ are also factors of $x^3 - 10x^2 + 29x - 20$, fully simplify

$$\frac{x^3 - 21x - 20}{x^3 + 10x^2 + 29x + 20}$$

Your turn

- a) Use the factor theorem to show that $(x - 1)$ and $(x - 4)$ are factors of $x^3 - 21x + 20$
- b) Given that $(x - 1)$ and $(x - 4)$ are also factors of $x^3 - 10x^2 + 29x - 20$, fully simplify

$$\frac{x^3 - 21x + 20}{x^3 - 10x^2 + 29x - 20}$$

a) Shown by substituting $x = 1$ and $x = 4$ into $x^3 - 21x + 20$ each giving an output of 0

b) $\frac{x + 5}{x - 5}$

Worked example

- a) Use the factor theorem to show that $(5x - 2)$ is a factor of $5x^3 - 37x^2 + 74x - 24$
- b) Hence factorise fully $5x^3 - 37x^2 + 74x - 24$
- c) Hence solve fully $5x^3 - 37x^2 + 74x - 24 = 0$

Your turn

- a) Use the factor theorem to show that $(2x - 5)$ is a factor of $2x^3 + 9x^2 - 11x - 60$
- b) Hence factorise fully $2x^3 + 9x^2 - 11x - 60$
- c) Hence solve fully $2x^3 + 9x^2 - 11x - 60 = 0$

a) $2\left(\frac{5}{2}\right)^3 + 9\left(\frac{5}{2}\right)^2 - 11\left(\frac{5}{2}\right) - 60 = \dots = 0$

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

c) $x = \frac{5}{2}, x = -3, x = -4$

Worked example

A sketch of $y = x^3 + bx^2 + cx + d$, where b , c and d are constants, has roots

$x = -5$, $x = -2$ and $x = 1$.

Find the values of b , c and d

Your turn

A sketch of $y = x^3 + bx^2 + cx + d$, where b , c and d are constants, has roots

$x = -1$, $x = 2$ and $x = 5$.

Find the values of b , c and d

$$b = -6, c = 3, d = 10$$