Topic Test 1 (20 minutes)

Numerical methods - Higher

1 Use trial and improvement to solve $x^3 + 2x = 90$
Give your answer to 1 decimal place.

Complete the table.

[4 marks]

x	$x^3 + 2x$	**Comment**
3	33	Too low

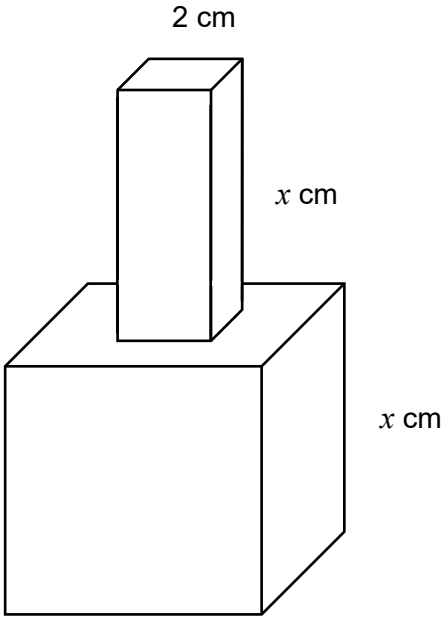
$x =$ _____

2 A solid is formed by a cube of side x cm and a cuboid with a square cross section of side 2 cm and a height of x cm

The volume of the solid is 270 cm^3

Use trial and improvement to work out the value of x.

Give your answer to 1 decimal place.



Complete the table.

[4 marks]

x	$x^3 + 4x$	**Comment**
7	371	Too high

$x =$ _____ cm

3 The quadratic equation $x^2 - 2x - 6 = 0$ can be rearranged to

$$x^2 = 2x + 6$$
$$x = \pm\sqrt{2x + 6}$$

3 (a) The iteration $u_{n+1} = +\sqrt{2u_n + 6}$ can be used to find the positive root.
Start with $u_1 = 3$

3 (a)(i) Write down u_2 and u_3 to 4 decimal places.

[2 marks]

$u_2 =$ _____ $u_3 =$ _____

3 (a)(ii) Use your calculator to continue the iteration to find the positive root to 3 decimal places.

[1 mark]

Answer _____

3 (b) The iteration $u_{n+1} = -\sqrt{2u_n + 6}$ can be used to find the negative root.
Start with $u_1 = -2$

3 (b)(i) Write down u_2 and u_3 to 4 decimal places.

[2 marks]

$u_2 =$ _____ $u_3 =$ _____

3 (b)(ii) Use your calculator to continue the iteration to find the negative root to 3 decimal places.

[1 mark]

Answer _____

3 (c) The quadratic equation $x^2 - 2x - 6 = 0$ has exact roots of $1 + \sqrt{7}$ and $1 - \sqrt{7}$

Evaluate $1 + \sqrt{7}$ and $1 - \sqrt{7}$ to 3 decimal places.

[1 mark]

Answer _____ and _____

4 The equation $x^3 + 2x^2 - 5 = 0$ can be rearranged in the following way

$$x^3 + 2x^2 - 5 = 0$$
$$x^2(x + 2) - 5 = 0$$
$$x^2 = \frac{5}{x + 2}$$
$$x = \sqrt{\frac{5}{x + 2}}$$

Use the iteration $\mathbf{u_{n+1} = \sqrt{\frac{5}{u_n + 2}}}$ with $u_1 = 2$

Write down the first 3 iterations and the solution to 3 decimal places

[3 marks]

$u_1 =$ 2

$u_2 =$ _____

$u_3 =$ _____

$u_4 =$ _____

$x =$ _____

5 (a) Use the iteration $u_{n+1} = \sqrt[3]{\frac{6}{u_n - 1}}$ to solve $x^4 - x^3 - 6 = 0$

Take $u_1 = 3$
Give your answer to 2 decimal places.

[1 mark]

$x =$ _____

5 (b) Verify that your answer is a solution to $x^4 - x^3 - 6 = 0$

[1 mark]

_____

_____