1. **Express** $\frac{4}{2-\sqrt{5}}$ in the form $a + b\sqrt{5}$ [3]

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2. **Evaluate**:

i. 5^0 [1]

ii. $2y^2 \times (3y^3)^2$ [2]

iii. $-2^{-1} + 32^{\frac{4}{5}}$ [3]

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3. **Solve** the following inequalities:

i. $3(x-5) \leq 24$ [2]

ii. $5x^2 - 2 > 78$ [2]

iii. $3x + 6x^{\frac{1}{2}} - 45 \leq 0$ [3]

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4. A is the point $(3,5)$ and B is the point $(-2,-4)$.

i. Find the equation of the line through A **parallel** to $y = 4x - 5$ giving your answer in the form $y = mx + c$ [3]

ii. Calculate the **length** of AB giving the answer in surd form. [3]

iii. Find the equation of the line which passes through the **mid-point** of AB and which is **perpendicular** to AB. Give your answer in the form $ax + by + c = 0$ where a, b and c are integers. [4]

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5. Consider the quadratic polynomial $2x^2 - 4x + 13$

i. Express $2x^2 - 4x + 13$ in the form $a(x-b)^2 + c$ where are a , b and c are **integers** to be found. [4]

ii. State the equation of the **line of symmetry** of $y = 2x^2 - 4x + 13$ [1]

iii. State the equation of the **tangent** to the curve $y = 2x^2 - 4x + 13$ at the **minimum** point. [1]

6. The diagram shows the curve with equation $f(x) = x^{\frac{1}{3}} - 1$ which crosses the coordinate axis at $A(1,0)$.

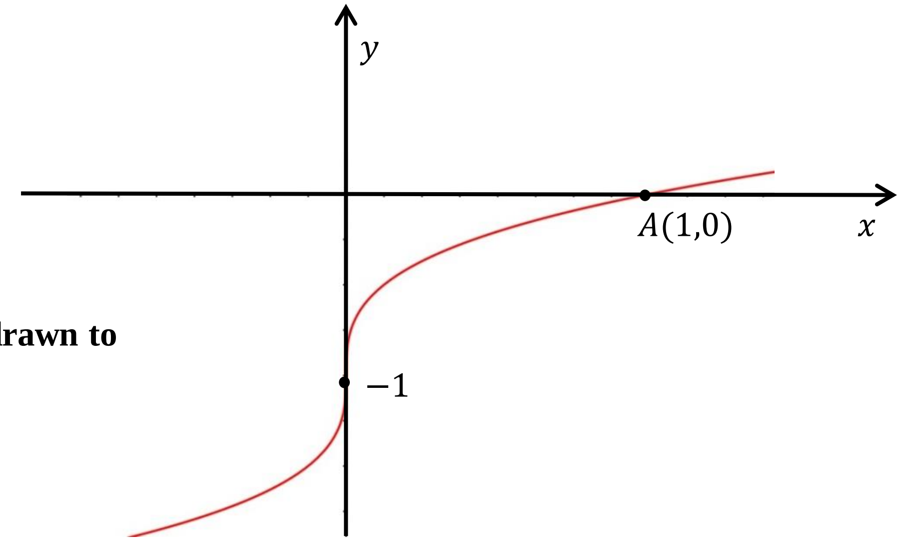


Diagram not drawn to scale

i. By indicating the coordinates of any **points of intersection** with the axes, sketch the following graphs on three separate diagrams:

a) $f(8x)$ [2]

b) $f\left(\frac{x}{8}\right)$ [2]

c) $f\left(\frac{x+1}{8}\right)$ [3]

ii. Describe the **transformation** that has taken place to obtain the graph in a) above. [2]

iii. The exact same curve with equation $y = f(8x)$ can be obtained via another set of **transformations**. Write down an equation $y = g(x)$ which is demonstrating this transformation. [2]

7. Rationalise the denominator in the following expressions:

a) $\dfrac{4}{\sqrt[5]{2^3}}$ b) $\dfrac{1}{1+\sqrt{2}-\sqrt{3}}$ c) $\dfrac{1}{\sqrt{2}+\sqrt{3}+\sqrt{5}}$ d) $\dfrac{\sqrt{3}}{1+\frac{1}{\sqrt{3}}}$

8. Simplify the following algebraic fractions where $n \in \mathbb{N}$.

$$\frac{(9^{n+2}-9^{n+1})^{\frac{1}{2}}}{(27^{n+1}-19\cdot 27^{n})^{\frac{1}{3}}} =$$

9. The value of x is defined as $x = a^{\frac{1}{3}} - a^{-\frac{1}{3}}$ where $a > 0$

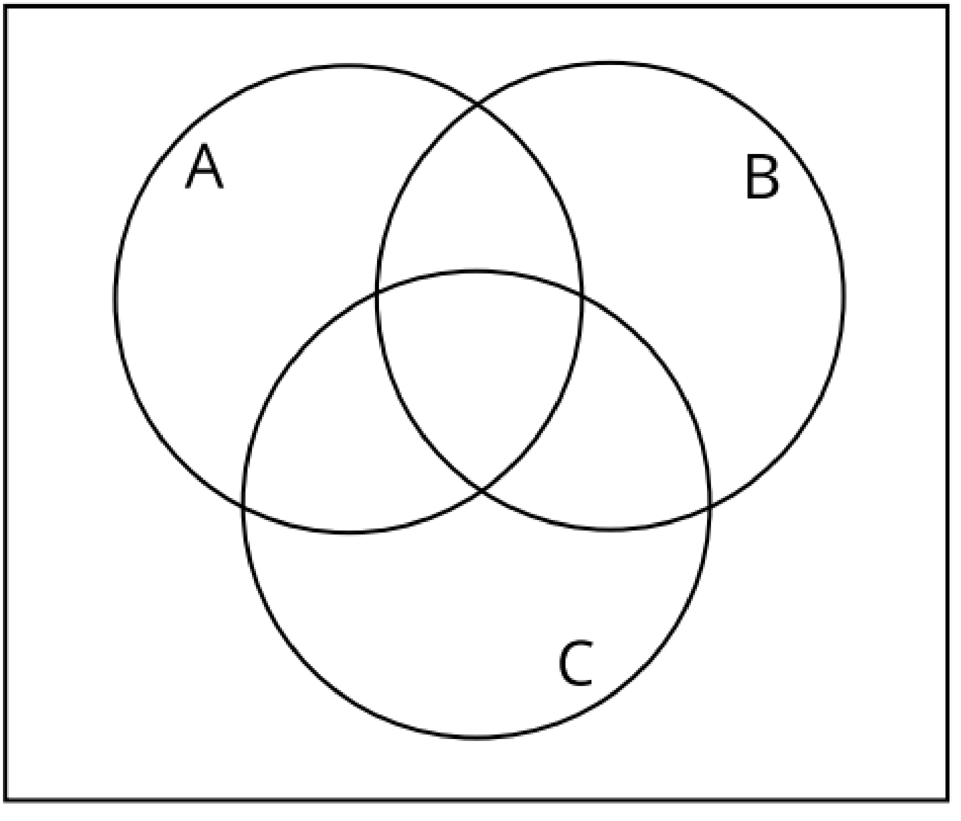
Show that $x^3 + 3x - a + \frac{1}{a} = 0$

10. The regions are defined as follows.

A: The solution set is a subset of $x \leq 1$.

B: The solutions are given by $a \leq x \leq b$ where a and b are real numbers.

C: The inequality is satisfied by $x = 4$, e.g. $x = 4$ satisfies the inequality $x \geq 2$.



Question 10 continues on the next page →

Here are some possible inequalities. Start by placing these into the correct region of the Venn diagram.

① $x^2 \le 9$	② $11x \ge 2x^2$	③ $x^2 + 3 \ge 2$
④ $3x^2 \ge 21x - 30$	⑤ $x^2 \le -x$	⑥ $x^2 \le x - 2$
⑦ $6x^2 - 1 \ge 5x$	⑧ $-2x^2 \le x - 6$	