1. Definition: A rational number is a real number that can be written in the form \[ \frac{\text{integer}}{\text{non-zero integer}} \] (2)

2. Solve \[ \frac{4x + 3}{4x + 1} = 3 \]

3. Solve \[ |2x + 4| + |x - 8| = 13 \]
4. Solve $|2 - 4x| > 1$. State your solution as an interval or union of intervals.

5. For each of the functions $g$ in parts A), B) and C) let $f$ be the function whose graph is shown below:

A) Let $g(x) = f(x + 1) - 2$. Describe how the graph of $g$ is formed from the graph of $f$ and accurately draw the graph of $g$ in the grid below:
B) Let $g(x) = f \left( \frac{1}{2} x + \frac{1}{2} \right)$. Describe how the graph of $g$ is formed from the graph of $f$ and accurately draw the graph in the grid below:

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  5  4  3  2  1
-5 -4 -3 -2 -1  1  2  3  4  5
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C) Let $g(x) = -2f(x + 1) + 1$. Describe how the graph of $g$ is formed from the graph of $f$ and accurately draw the graph of $g$ in the grid below:

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  5  4  3  2  1
-5 -4 -3 -2 -1  1  2  3  4  5
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6. Let \( f(x) = \frac{3}{4}x + 1 \) be restricted to the domain \([-4,4]\)

A) Draw the graphs of \( f \) and \( f^{-1} \) in the grid below. Use a dashed line to indicate the graph of \( f^{-1} \).

B) Domain of \( f^{-1} = \) \( \) Range of \( f^{-1} = \) \( \)

C) Find a formula for \( f^{-1}(x) \).

7. Find the slope intercept equation of the line that contains the point \((8,2)\) and is perpendicular to the line that has the equation \(2x + 4y = 5\).
8. Find the two points on the line $y = 2x$ that are 5 units from the point (6,2). (Hint: A point on the line $y = 2x$ is of the form $(x,2x)$)

9. A) By completing the square, rewrite the equation $y = -\frac{1}{2}x^2 + x + \frac{5}{2}$ in the form $y = -\frac{1}{2}(x - a)^2 + b$ and explain how the graph of $y = -\frac{1}{2}x^2 + x + \frac{5}{2}$ is formed from the graph of $y = -\frac{1}{2}x^2$ using transformations.
B) Accurately draw the graph of $y = -\frac{1}{2}x^2 + x + \frac{5}{2}$ in the grid below, indicating the vertex and four other points that have integer coordinates.

10. Find all real numbers $x$ that satisfy $x + \sqrt{x} = 6$.

11. Find the centre and the radius of the circle with the equation $x^2 + y^2 - 10x + 6y = 66$. 
12. Given that 1 is a zero of \( p(x) = 6x^3 - 19x^2 + 19x - 6 \), find the other two real zeros.

13. Find all the real numbers \( x \) such that \( 2^{2x} - 5 \cdot 2^{x+1} + 16 = 0 \).
14. Solve for $x$: $\log_3(5x + 1) + \log_3(2x + \frac{1}{5}) = 1$.

15. Solve for $x$: $\log_2 x - \log_4(4 - 4) = 2$. 

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16. Given that \( \log_2 x = \frac{1}{3} \) and \( \log_2 y = \frac{1}{4} \) find the exact value of \( \log_2 \left( \frac{64x^4}{\sqrt{4y}} \right) \).

17. Accurately draw the angle 300° in the unit circle below and give the exact values of the trigonometric point (the endpoint of the radius that corresponds to 300°)

18. Find the four smallest positive numbers \( \theta \) such that \( \cos \theta = -\frac{1}{2} \) (Answer in radians)
19. Suppose that $\frac{\pi}{2} < \theta < \pi$ and $\csc \theta = 4$. Find the exact value of $\cos \theta$.

20. Given that $\tan \theta = 4$ in the diagram below, find the exact values of a and b.
21. Find the exact values of all the numbers $x$ in $[0, 2\pi]$ such that $2\cos^2 x + \cos x - 1 = 0$.

22. Given the triangle shown below, find the exact values of sides $b$ and $c$.

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23. If \(0 < \theta < \frac{\pi}{2}\) and \(\cos \theta = \frac{2}{3}\), find the exact value of \(\cot 2\theta\).

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24. Find the exact value of \(\cos(\cos^{-1} \left( \frac{3}{5} \right) + \cos^{-1} (-\frac{4}{5}))\)

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Total: 100