Sketch the graph \( y = e^{x+2} \). State the equation of a straight line that can be drawn to solve the equation \( x + 2 = \ln(x + 1) - \ln 2 \).

\[
\begin{align*}
x + 2 &= \ln(x + 1) - \ln 2 \\
x + 2 &= \ln\left(\frac{x+1}{2}\right) \\
e^{x+2} &= \frac{x+1}{2} \\
A \text{ suitable straight line is } y &= \frac{x+1}{2}
\end{align*}
\]
2 The figure shows part of the graph of \( y = |ax - 4| + b \) where \( C(1, -2) \) is the minimum point of the graph.

i) State the value of \( b \)
ii) Find the value of \( a \)
iii) Find the coordinates of \( A, B \) and \( D \).

iv) Write down the range of values of \( x \) for which \( y \) is negative.

\[ b = -2 \]

\[ \text{Sub } (1, -2) \text{ into equation:} \]
\[ -2 = |a(1) - 4| - 2 \]
\[ a - 4 = 0 \]
\[ a = 4 \]

\[ \text{iii) When } x = 0, \]
\[ y = |0 - 4| - 2 = 2 \]
Coordinates of \( A \) is \((0, 2)\)

When \( y = 0, \)
\[ 0 = |4x - 4| - 2 \]
\[ 0 = (4x - 4) - 2 \quad \text{or} \quad 0 = (-4x + 4) - 2 \]
\[ 4x = 6 \quad \text{or} \quad 4x = 2 \]
\[ x = 1.5 \quad \text{or} \quad x = 0.5 \]
Coordinates of \( B \) is \((0.5, 0)\) and Coordinates of \( D \) is \((1.5, 0)\)

\[ \text{iv) } 0.5 < x < 1.5 \]
The diagram show part of the graph of \( y = a - |bx + c| \) where \( b > 0 \). Given that it passes through the points \( B(2,3) \) and \( C(5,-6) \),

i) Find the values of \( a, b \) and \( c \)

ii) Find the \( x \)-intercepts and the \( y \)-intercept of the graph.

i) By observation, \( a = 3 \).

Gradient of line BC = \( \frac{-6-3}{5-2} \)

\( = -3 \)

Since \( b > 0 \), \( b = 3 \)

Sub \( (2,3) \) into equation:

\[ 3 = 3 - |3(2) + c| \]

\( c = -6 \)

\( \therefore \) Equation is \( y = 3 - |3x - 6| \)

ii) When \( x = 0 \),

\( y = 3 - |0 - 6| = -3 \)

\( y \)-intercept is \((0,-3)\)

When \( y = 0 \),

\( 0 = 3 - |3x - 6| \)

\( 3x - 6 = 3 \) or \( 3x - 6 = -3 \)

\( x = 3 \) or \( x = 1 \)

\( x \)-intercepts are \((1,0)\) and \((3,0)\).
4 Sketch the graph $y = 3 \ln(x + 1)$. On the same graph, add a suitable straight line which will help solve the equation $(x + 1)e^{\frac{3}{x} + 1} = e^2$. State the equation of the straight line.

\[(x + 1)e^{\frac{3}{x} + 1} = e^2\]
\[(x + 1) = e^{\frac{1}{3} - \frac{3}{x}}\]
\[\ln(x + 1) = 1 - \frac{1}{3}x\]
\[3 \ln(x + 1) = 3 - x\]

The straight line is $y = 3 - x$

5 Solve the equation $|−3x + 21| = 8x + |x − 7|$.

\[|−3x + 21| = 8x + |x − 7|\]
\[|−3(x − 7)| = 8x + |x − 7|\]
\[|−3||x − 7| − |x − 7| = 8x\]
\[|x − 7|(3 − 1) = 8x\]
\[x − 7 = 4x\quad \text{or}\quad x − 7 = −4x\]
\[x = −\frac{7}{3}\quad \text{or}\quad x = \frac{7}{5}\]

Check by Substitution:
\[x = −\frac{7}{3}\quad \text{or}\quad x = \frac{7}{5}\]
\[LHS = −3(−\frac{7}{3}) + 21 = 28\quad \text{or}\quad LHS = −3(\frac{7}{5}) + 21 = \frac{84}{5}\]
\[RHS = 8(−\frac{7}{3}) + (−\frac{7}{3}) − 7 = −\frac{28}{3}\quad \text{or}\quad RHS = 8(\frac{7}{5}) + (\frac{7}{5}) − 7 = \frac{84}{5}\]
\[LHS \neq RHS, \therefore x = −\frac{7}{3}\text{ is rejected}\]
\[LHS = RHS, \therefore x = \frac{84}{5}\]
6
i) On the same diagram, sketch the graphs of $y = |2x|$ and $y = |x + 3|$.
ii) State the number of solutions of the equation for $|2x| = |x + 3|$.
iii) Find the coordinates of the intersection points of the 2 graphs.
iv) Hence, state the solution of $|2x| > |x + 3|$.

i) 2 solutions

$|2x| = |x + 3|

$2x = x + 3$ or $2x = -x - 3$

$x = 3$ or $x = -1$

$y = 6$ or $y = 2$

Coordinates of intersection points are $(−1,2)$ and $(3,6)$

iv) $x < −1$ or $x > 3$
7  a) Solve the equation \(|x - 2| = 2 - 4x\)

b) The diagram shows part of the graph of \(y = 4 - |2x - 3|\). Find the coordinates of 
\(A, B\) and \(C\).

\[
\begin{align*}
  \text{a)} & \quad |x - 2| = 2 - 4x \\
  & \quad (x - 2) = 2 - 4x \\
  & \quad x = \frac{4}{5} \text{ (Rej)} \\
  \text{or} & \quad (x - 2) = -2 + 4x \\
  & \quad x = 0 \\

\text{Substitute } x = \frac{4}{5} \text{ back into equation:} \\
& \quad |\frac{4}{5} - 2| = 2 - 4 \left(\frac{4}{5}\right) \\
& \quad \frac{6}{5} \neq -\frac{6}{5} \\
& \quad \therefore x = \frac{4}{5} \text{ is rejected} \\

\text{Substitute } x = 0 \text{ back into equation:} \\
& \quad |0 - 2| = 2 - 4(0) \\
& \quad 2 = 2 \\
& \quad \therefore x = 0
\end{align*}
\]

\[
\begin{align*}
  \text{b)} & \quad \text{When } x = 0, \\
  & \quad y = 4 - |2(0) - 3| \\
  & \quad = 1 \\
  & \quad \therefore A(0, 1) \\
  \text{When } y = 0, \\
  & \quad 0 = 4 - |2x - 3| \\
  & \quad 2x - 3 = 4 \quad \text{ or } \quad 2x - 3 = -4 \\
  & \quad x = 3.5 \quad \text{ or } \quad x = -0.5 \\
  & \quad \therefore C(3.5, 0)
\end{align*}
\]

\[
\begin{align*}
  \text{\(y\)-coordinate of } B & = 4 \\
  \text{When } y = 4, \\
  & \quad 4 = 4 - |2x - 3| \\
  & \quad 2x - 3 = 0 \\
  & \quad x = 1.5 \\
  & \quad \therefore B(1.5, 4)
\end{align*}
\]
8 Solve the inequality $|2x^2 + 4x - 11| > 5$

$(2x^2 + 4x - 11) > 5$ or $-(2x^2 + 4x - 11) > 5$

$2x^2 + 4x - 11 > 5$ or $2x^2 + 4x - 11 < -5$

$2x^2 + 4x - 16 > 0$ or $2x^2 + 4x - 6 < 0$

$(x + 4)(x - 2) > 0$ or $(x + 3)(x - 1) < 0$

$x < -4$ or $x > 2$ or $-3 < x < 1$

$\therefore x < -4 \text{ or } -3 < x < 1 \text{ or } x > 2$
9 i) Sketch the graph \( y = |x^2 - 2x| \) indicating the intercepts and coordinates of the turning point.

ii) In each of the following case, determine the number of solutions of the equation \( |x^2 - 2x| = mx + c \) where \( 0 < c < 1 \), justify your answer.

   a) \( m = 0 \)

   b) \( m = -1 \)

i) Plot \( y = x^2 - 2x \) first, then reflect portions of graph below \( x \)-axis on the \( x \)-axis.

\[
y = x(x - 2)
\]

\( x \)-intercepts are at (0,0) and (2,0).

Since quadratic graph is symmetrical, turning point is at \( x = 1 \).

At \( x = 1 \), \( y = 1(1 - 2) = -1 \)

Turning point is \( (1, -1) \)

Sub \( x = 0 \),

\[
y = 0
\]

\( y \)-intercept is (0,0).

iiia) There are 4 solutions since the graphs cut at 4 points.

iib) There are 2 solutions since the graphs cut at 2 points.
10  

i) Sketch the graph of \( y = |3x - 2| \) for \(-1 < x < 2\). 

ii) State the corresponding range of \( y \). 

iii) Find the range of values of \( c \) for which \( |3x - 2| = 3x + c \) has only one solution for \(-1 < x < 3\). 

Range of \( y \) is \( 0 \leq y < 5 \) 

Range of \( c \) is \(-2 < c < 8 \)