

<p><i>The set <math>\mathbb{N}</math> contains?</i></p> <p>1</p>	<p><i>The set <math>\mathbb{R}</math> contains?</i></p> <p>2</p>
<p><i>The set <math>\mathbb{Z}</math> contains?</i></p> <p>3</p>	<p><i>The set <math>\mathbb{Q}</math> contains?</i></p> <p>4</p>
<p><i>What is this?</i> <math>\emptyset</math></p> <p>5</p>	<p><i>What is this?</i> <math>\mathbb{S}</math></p> <p>6</p>
<p><i>What does <math>X \subseteq Y</math> mean?</i></p> <p>7</p>	<p><i>What does ' mean after a set (or <math>^c</math>)?</i></p> <p>8</p>
<p><i>What does <math>x \in X</math> mean?</i></p> <p>9</p>	<p><i>What does <math>x \notin X</math> mean?</i></p> <p>10</p>
<p><i>For each <math>a</math> in <math>X</math>, <math>a \in X \leftrightarrow a \in Y</math>. How is this represented?</i></p> <p>11</p>	<p><i>How else could we express: <math>X \subseteq Y \leftrightarrow Y \subseteq X</math></i></p> <p>12</p>

The set of real numbers (all finite and infinite decimal numbers).

The set of natural numbers (all non-negative integers).

2

1

The set of rational numbers.  
Contains all  $m/n$  for  $m, n \in \mathbb{Z}$

The set of integers.

4

3

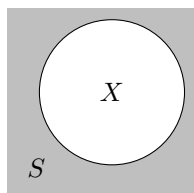
The universal set, containing all possible elements.

The null set.

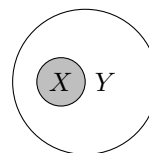
6

5

The complement of the set. E.g.  $X'$ :



$X$  is a subset of  $Y$   
 $Y$  is a superset of  $X$   
 $X$  is included in  $Y$   
 $Y$  includes  $X$



8

7

$x$  is not a member of  $X$

$x$  is contained in / is a member of  $X$

10

9

$$X = Y$$

$$X = Y$$

12

11

What does  $X \cup Y$  mean?

13

What does  $X \cap Y$  mean?

14

The truth table for the **and** function is:

Input 1	Input 2	Input 1 <b>and</b> Input 2
<i>T</i>	<i>T</i>	
<i>T</i>	<i>F</i>	
<i>F</i>	<i>T</i>	
<i>F</i>	<i>F</i>	

15

The truth table for the **or** function is:

Input 1	Input 2	Input 1 <b>or</b> Input 2
<i>T</i>	<i>T</i>	
<i>T</i>	<i>F</i>	
<i>F</i>	<i>T</i>	
<i>F</i>	<i>F</i>	

16

The truth table for the **implies** function is:

Input 1	Input 2	Input 1 <b>implies</b> Input 2
<i>T</i>	<i>T</i>	
<i>T</i>	<i>F</i>	
<i>F</i>	<i>T</i>	
<i>F</i>	<i>F</i>	

17

An operation is  if:

$$a1 \circledast a2 = a2 \circledast a1$$

18

An operation is  if:

$$(a1 \circledast a2) \circledast a3 = a1 \circledast (a2 \circledast a3)$$

19

Is  $(v + w + x)$  a valid expression in the formal language?

20

Is  $(x + 4)$  a valid expression in the formal language?

21

Is  $((x \times 0) + (y + z))$  a valid expression in the formal language?

22

What expression does this parse tree represent?

$$\frac{\frac{y}{x} \cdot z}{\cdot} (\times)$$

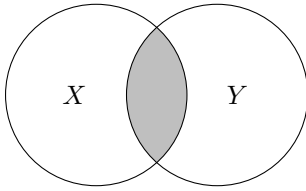
23

Evaluate the following parse tree

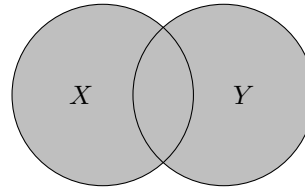
$$\frac{140 \cdot \frac{10 \cdot \frac{3}{1}}{\cdot}}{\cdot} (\div)$$

24

The *intersection* of the sets  $X$  and  $Y$ .



The **union** of the sets  $X$  and  $Y$ .



The truth table for the **or** function is:

<i>Input 1</i>	<i>Input 2</i>	<i>Input 1 or Input 2</i>
<i>T</i>	<i>T</i>	<i>T</i>
<i>T</i>	<i>F</i>	<i>T</i>
<i>F</i>	<i>T</i>	<i>T</i>
<i>F</i>	<i>F</i>	<i>F</i>

The truth table for the **and** function is:

<i>Input 1</i>	<i>Input 2</i>	<i>Input 1 and Input 2</i>
<i>T</i>	<i>T</i>	<i>T</i>
<i>T</i>	<i>F</i>	<i>F</i>
<i>F</i>	<i>T</i>	<i>F</i>
<i>F</i>	<i>F</i>	<i>F</i>

*An operation is commutative if:*

$$a1 \circledast a2 = a2 \circledast a1$$

The truth table for the *implies* function is:

<i>Input 1</i>	<i>Input 2</i>	<i>Input 1 implies Input 2</i>
<i>T</i>	<i>T</i>	<i>T</i>
<i>T</i>	<i>F</i>	<i>F</i>
<i>F</i>	<i>T</i>	<i>T</i>
<i>F</i>	<i>F</i>	<i>T</i>

No, there aren't enough brackets.  
 $((v + w) + x)$  would be valid though!

*An operation is associative if:*

$$(a1 \circledast a2) \circledast a3 = a1 \circledast (a2 \circledast a3)$$

No, since there are too many brackets.  
 $((x \times 0) + (y + z))$  would be valid though!

No, since 4 isn't an allowable atom.  
 $(x + 0)$  would be valid though!

$$(140 \div (10 - (3 \times 1))) = 20$$

$$\begin{array}{r} \frac{140}{20} \quad \frac{10}{7} \quad \frac{3}{3} \quad \frac{1}{1} \quad \begin{matrix} (\times) \\ (-) \\ (\div) \end{matrix} \end{array}$$

$$(x - (y \times z))$$

<p><i>Use the fact that <math>\cup</math> is associative to re-arrange:</i></p> $X \cup (Y \cup Z)$ <p>25</p>	<p><i>Use the fact that <math>\cap</math> is associative to re-arrange:</i></p> $X \cap (Y \cap Z)$ <p>26</p>
<p><i>Use the distributive law on:</i></p> $X \cup (Y \cap Z)$ <p>27</p>	<p><i>Use the distributive law on:</i></p> $X \cap (Y \cup Z)$ <p>28</p>
<p><i>Use absorbsion on:</i></p> $X \cup (X \cap Y)$ <p>29</p>	<p><i>Use absorbsion on:</i></p> $X \cap (X \cup Y)$ <p>30</p>
<p><i>What three things happen when De Morgan's law is applied to an expression?</i></p> <p>31</p>	<p><i>What does involution mean?</i></p> <p>32</p>
<p><i>What is the symbol for logical negation?</i></p> <p>33</p>	<p><i>What is the symbol for conjunction?</i></p> <p>34</p>
<p><i>What is the symbol for disjunction?</i></p> <p>35</p>	<p><i>What is the symbol for logical and?</i></p> <p>36</p>

$$Y \cap (X \cap Z)$$

*or*

$$Z \cap (X \cap Y)$$

26

$$Y \cup (X \cup Z)$$

*or*

$$Z \cup (X \cup Y)$$

25

$$(X \cup Y) \cap (X \cup Z)$$

28

$$(X \cap Y) \cup (X \cap Z)$$

27

$$X$$

30

$$X$$

29

*If an expression is negated twice, they cancel each other out.*  
 $X'' = X$

32

1. *The expression is negated (involution is applied if it's already negated)*
2. *Each sub expression is negated (again, applying involution)*
3. *Each union inside the expression is turned into an intersection and vice versa*

31

$$\wedge$$

34

$$\neg$$

33

$$\wedge$$

36

$$\vee$$

35

What is the symbol for logical or?

37

What is the symbol for implication?

38

What is the symbol for bi-implication?

39

The truth table for the **bi-implication** function is:

Input 1	Input 2	Input 1 $\iff$ Input 2
<i>T</i>	<i>T</i>	
<i>T</i>	<i>F</i>	
<i>F</i>	<i>T</i>	
<i>F</i>	<i>F</i>	

40

An expression is a  when all of it's possible outcomes are true

41

An expression is  when at least one of it's possible outcomes are true

42

An expression is a  when none of it's possible outcomes are true

43

What is the notation to say  $A$  is a tautology?

44

What is the notation to say  $A$  is satisfiable?

45

What is the notation to say  $A$  is a contradiction?

46

Use the fact that  $\cup$  is associative to re-arrange:  
$$X \vee (Y \vee Z)$$

47

Use the fact that  $\cap$  is associative to re-arrange:  
$$X \wedge (Y \wedge Z)$$

48

$\implies$

$\vee$

38

37

The truth table for the **bi-implication** function is:

Input 1	Input 2	Input 1 $\iff$ Input 2
<i>T</i>	<i>T</i>	<i>T</i>
<i>T</i>	<i>F</i>	<i>F</i>
<i>F</i>	<i>T</i>	<i>F</i>
<i>F</i>	<i>F</i>	<i>T</i>

$\iff$

40

39

An expression is *satisfiable* when at least one of it's possible outcomes are true

An expression is a *tautology* when all of it's possible outcomes are true

42

41

$\models A$

An expression is a *contradiction* when none of it's possible outcomes are true

44

43

$\not\models A$

$\not\models \neg A$

46

45

$Y \wedge (X \wedge Z)$   
or  
 $Z \wedge (X \wedge Y)$

$Y \vee (X \vee Z)$   
or  
 $Z \vee (X \vee Y)$

48

47



<p><i>What are the two possible rearrangements of <math>A \implies B</math>?</i></p> <p>49</p>	<p><i>What is the rearrangement of <math>\neg(A \implies B)</math></i></p> <p>50</p>
<p><i>What is the rearrangement of <math>A \implies \neg B</math>?</i></p> <p>51</p>	<p><i>Rearrange <math>A \iff B</math></i></p> <p>52</p>
<p><i>Rearrange <math>A \iff B</math></i></p> <p>53</p>	<p><i>Rearrange <math>A \iff B</math></i></p> <p>54</p>
<p><i>Rearrange <math>\neg(A \iff B)</math></i></p> <p>55</p>	<p><i>Rearrange <math>\neg(A \iff B)</math></i></p> <p>56</p>
<p><i>What is the arity of a unary symbol?</i></p> <p>57</p>	<p><i>Is disjunction inclusive or exclusive?</i></p> <p>58</p>
<p><i>What does 'iff' mean?</i></p> <p>59</p>	<p><i>What does 'PL' stand for?</i></p> <p>60</p>

$$A \wedge \neg B$$

50

$$\begin{array}{l} \neg A \vee B \\ \neg B \implies \neg A \end{array}$$

49

$$(A \implies B) \wedge (B \implies A)$$

52

$$B \implies \neg A$$

51

$$(A \wedge B) \vee (\neg A \wedge \neg B)$$

54

$$(\neg A \vee B) \wedge (\neg B \vee A)$$

53

$$\neg(A \wedge B) \wedge (A \vee B)$$

56

$$(A \wedge \neg B) \vee (B \wedge \neg A)$$

55

*Inclusive.*

58

*1*

57

*Propositional Logic*

60

*If and only if.*

59

*What is a truth valuation?*

*If  $A \implies B$  is a tautology, what does that mean?*

*A and B are logically equivalent.*

*A truth valuation is a list of values define the input values for  
an expression. E.g.:  
( $x = T, y = F$ )*