n8n Automation

Master Cheatsheet 2025

Complete Guide | Nodes | Expressions | AI | Workflows

■ What is n8n?

n8n = Open-source workflow automation tool. Connect apps, automate tasks, build AI agents - with code when you need it!

Feature	n8n	Zapier	Make
Open Source	Yes	No	No
Self-Hosting	Free	No	No
Code Support	JS/Python	Limited	Limited
AI Nodes	Built-in	Add-on	Add-on
Pricing	Free (self) / $20+	$20+/mo	$9+/mo
Executions	Unlimited (self)	Limited	Limited
Complex Logic	Excellent	Basic	Good

■■ Installation & Setup

Method	Command / Steps	Best For
npm (Local)	npm install n8n -g && n8n start	Quick testing
npx (No install)	npx n8n	One-time use
Docker	docker run -p 5678:5678 n8nio/n8n	Self-hosting
Docker Compose	docker-compose up -d	Production
n8n Cloud	app.n8n.cloud (sign up)	No maintenance
Railway	One-click deploy	Easy cloud hosting
Render	Deploy from GitHub	Free tier available

```
# docker-compose.yml
version: '3.8'
services:
n8n:
image: n8nio/n8n
ports:
- '5678:5678'
environment:
- N8N_BASIC_AUTH_ACTIVE=true
- N8N_BASIC_AUTH_USER=admin
- N8N_BASIC_AUTH_PASSWORD=password
- WEBHOOK_URL=https://your-domain.com/
volumes:
- n8n_data:/home/node/.n8n
volumes:
n8n_data:
```

■ Core Concepts

Concept	Description	Example
Workflow	A sequence of connected nodes	Email - Process - Save to DB
Node	Single step/action in workflow	HTTP Request, Gmail, Slack
Trigger	Starts the workflow	Webhook, Schedule, App event
Connection	Links nodes together	Output to Input
Execution	One run of a workflow	Triggered at 9 AM daily
Credential	Stored auth for services	Gmail OAuth, API keys
Expression	Dynamic values using {{ }}	{{ $json.email }}
Item	Single data object in flow	One row, one email, one record
Branch	Split workflow paths	IF true - A, IF false - B

■ Trigger Nodes (Start Workflows)

Trigger Type	Node Name	Use Case
Manual	Manual Trigger	Testing, on-demand runs
Schedule	Schedule Trigger	Run every hour/day/week
Webhook	Webhook	Receive HTTP requests
App Triggers	Gmail, Slack, etc.	New email, new message
Form	n8n Form Trigger	User submits a form
Chat	Chat Trigger	Chatbot conversations
File	Local File Trigger	File added/modified
RSS	RSS Feed Trigger	New feed item
IMAP	IMAP Email	New email (any provider)
Postgres/MySQL	DB Trigger	New row inserted

■ ***Webhook URL format: https://your-n8n.com/webhook/workflow-id or /webhook-test/ for testing***

■ Popular Integrations (400+ Nodes)

Category	Nodes
Communication	Gmail, Outlook, Slack, Discord, Telegram, WhatsApp, Twilio, SendGrid
CRM	HubSpot, Salesforce, Pipedrive, Zoho CRM, Airtable
Project Mgmt	Notion, Trello, Asana, Monday.com, Jira, ClickUp, Linear
Databases	PostgreSQL, MySQL, MongoDB, Redis, Supabase, Firebase
Cloud Storage	Google Drive, Dropbox, OneDrive, AWS S3, Google Sheets

E-commerce	Shopify, WooCommerce, Stripe, PayPal, Gumroad
Social Media	Twitter/X, LinkedIn, Facebook, Instagram, YouTube
AI/ML	OpenAI, Anthropic, Google AI, Hugging Face, Pinecone
Dev Tools	GitHub, GitLab, Bitbucket, Jenkins, Vercel, Netlify
Marketing	Mailchimp, ConvertKit, ActiveCampaign, Google Analytics

Logic & Flow Control Nodes

Node	Purpose	When to Use
IF	Conditional branching (true/false)	Route based on condition
Switch	Multiple branches based on value	3+ possible paths
Merge	Combine data from branches	After IF/Switch rejoins
Loop Over Items	Process items one by one	Rate limiting, sequential
Split In Batches	Process in groups	Batch API calls
Wait	Pause execution	Delay between steps
No Operation	Pass data through	Placeholder, debugging
Filter	Keep only matching items	Remove unwanted data
Remove Duplicates	Deduplicate items	Clean data
Sort	Order items	Alphabetical, numerical
Limit	Keep first N items	Top 10 results
Compare Datasets	Find differences	Sync two sources
Aggregate	Combine items into one	Sum, count, concatenate

Merge Node Modes

Mode	Description	Result
Append	Add all items from both inputs	[A1, A2, B1, B2]
Combine	Match by position or field	[A1+B1, A2+B2]
Choose Branch	Take from one input only	[A1, A2] or [B1, B2]
Combine All	Create all combinations	[A1+B1, A1+B2, A2+B1...]

Expressions & Data Access

Use {{ }} for expressions. Click any field - Expression tab - Build dynamic values

Expression	Description	Example Output
{{ $json.fieldName }}	Access current item field	{{ $json.email }} = john@test.com
{{ $json.nested.field }}	Access nested field	{{ $json.user.name }} = John
{{ $json["field-name"] }}	Field with special chars	{{ $json["first-name"] }}

{{ $item.index }}	Current item index	0, 1, 2, ...
{{ $input.first().json }}	First item of input	First record
{{ $input.last().json }}	Last item of input	Last record
{{ $input.all() }}	All input items	Array of all items
{{ $('Node').item.json }}	Data from specific node	Reference other node
{{ $('Node').first().json }}	First item from node	First record from node
{{ $now }}	Current datetime	2025-01-15T10:30:00
{{ $today }}	Today date	2025-01-15
{{ $workflow.id }}	Current workflow ID	wf_abc123
{{ $execution.id }}	Current execution ID	exec_xyz789
{{ $vars.myVar }}	Workflow variable	Variable value

Common Expression Methods

Method	Description	Example
.toString()	Convert to string	{{ $json.id.toString() }}
.toNumber()	Convert to number	{{ $json.price.toNumber() }}
.toBoolean()	Convert to boolean	{{ $json.active.toBoolean() }}
.toLowerCase()	Lowercase string	{{ $json.name.toLowerCase() }}
.toUpperCase()	Uppercase string	{{ $json.name.toUpperCase() }}
.trim()	Remove whitespace	{{ $json.text.trim() }}
.split(",")	Split string to array	{{ $json.tags.split(",") }}
.slice(0, 10)	Substring	{{ $json.desc.slice(0, 100) }}
.includes("text")	Check if contains	{{ $json.email.includes("@") }}
.replace("a", "b")	Replace text	{{ $json.text.replace("old", "new") }}
.length	Array/string length	{{ $json.items.length }}
.isEmpty()	Check if empty	{{ $json.name.isEmpty() }}

HTTP Request & Webhooks

Setting	Options	Description
Method	GET, POST, PUT, PATCH, DELETE	HTTP method
URL	https://api.example.com/endpoint	API endpoint
Authentication	None, Basic, Header, OAuth2	Auth method
Headers	Content-Type, Authorization	Custom headers
Query Parameters	key=value pairs	URL parameters
Body	JSON, Form Data, Raw	Request payload

Response Format	JSON, Text, File	Expected response
Timeout	Milliseconds	Request timeout
Retry on Fail	Number of retries	Auto retry

Webhook Response Modes

Response Mode	Description
Immediately	Respond before workflow completes (default)
When Last Node Finishes	Wait for workflow, return last node output
Using Respond to Webhook	Custom response anywhere in workflow

Code Node (JavaScript/Python)

```
// JavaScript - Process all items
const results = [];
for (const item of $input.all()) {
results.push({
json: {
name: item.json.name.toUpperCase(),
processed: true,
timestamp: new Date().toISOString()
}
});
}
return results;

// Access other nodes
const webhookData = $('Webhook').first().json;
const allEmails = $('Gmail').all().map(i => i.json.email);
```

Method	Description
$input.all()	Get all input items
$input.first()	Get first input item
$input.last()	Get last input item
$input.item	Current item (Run Once Per Item mode)
$('NodeName').all()	Get all items from a node
$('NodeName').first().json	Get first item JSON from node
$execution.id	Current execution ID
$workflow.id	Current workflow ID
$now	Current DateTime
$vars.varName	Access workflow variable
$env.VAR_NAME	Access environment variable

AI & LLM Nodes

Node	Purpose	Use Case

AI Agent	Autonomous AI with tools	Complex reasoning, multi-step
Basic LLM Chain	Simple prompt to response	Text generation, Q&A
Conversational Agent	Chat with memory	Chatbots
OpenAI Chat Model	GPT-4, GPT-4o	OpenAI integration
Anthropic Chat Model	Claude Sonnet/Opus	Claude integration
Ollama Chat Model	Local LLMs	Self-hosted AI
Text Classifier	Categorize text	Sentiment, intent detection
Summarization Chain	Summarize documents	Long text to short
Vector Store	Store embeddings	RAG, semantic search
Embeddings	Text to vectors	OpenAI, Ollama embeddings
Information Extractor	Extract structured data	Entities from text

AI Agent Tools

Tool	Description
Calculator	Math calculations
Code Tool	Execute JavaScript/Python
HTTP Request Tool	Make API calls
Wikipedia	Search Wikipedia
SerpAPI	Google search results
Vector Store Tool	Search your documents (RAG)
Workflow Tool	Call other n8n workflows
Custom Tool	Define your own tools

Error Handling

Method	How to Configure	Behavior
Stop Workflow	Default behavior	Workflow stops on error
Continue on Fail	Node Settings - On Error	Continue to next node
Continue (Regular)	On Error - Continue Regular	Send to regular output
Continue (Error)	On Error - Continue Error	Send to error branch
Error Trigger	Add Error Trigger node	Catch all workflow errors
Retry	Node Settings - Retry on Fail	Auto retry N times

Pro Tip: Add Error Trigger - Slack/Email node to get notified of failed workflows!

Data Transformation Nodes

Node	Purpose	Example
Set	Add/modify fields	Add fullName = first + last
Edit Fields	Rename, reorder, remove	Clean up data structure
Convert to File	JSON to CSV/Excel	Export data
Extract from File	CSV/Excel to JSON	Import data
HTML Extract	Scrape web pages	Get data from HTML
XML	Parse/create XML	SOAP APIs
JSON	Parse JSON string	Nested JSON handling
Crypto	Hash, encrypt, decode	SHA256, Base64
Date & Time	Format, calculate dates	Add 7 days, format date
Compression	Zip/unzip files	File handling

■ Best Practices

Category	Best Practice
Naming	Use descriptive node names: "Get New Orders" not "HTTP Request"
Organization	Add Sticky Notes to document complex logic
Error Handling	Always add Error Trigger for critical workflows
Testing	Use Manual Trigger + test data before activating
Credentials	Never hardcode API keys - use Credentials
Performance	Use Split In Batches for large datasets
Performance	Add Wait nodes to respect API rate limits
Debugging	Check execution data in each node output
Versioning	Export workflows as JSON backups
Security	Use environment variables for sensitive config
Webhooks	Use unique webhook paths, not default IDs

■ Common Workflow Patterns

Pattern	Nodes Used	Example
API to Database	HTTP Request - Postgres	Sync external data
Form to Email	Form Trigger - Gmail	Contact form handling
Schedule to Report	Schedule - Query - Email	Daily reports
Webhook API	Webhook - Code - Respond	API endpoint
Email AI Reply	IMAP - OpenAI - Gmail	Auto email response
RSS to Social	RSS - Twitter + LinkedIn	Auto post content

CRM to Slack	HubSpot Trigger - Slack	New lead alerts
AI Chatbot	Chat Trigger - Agent - Respond	Support bot
RAG Pipeline	Docs - Embeddings - Vector	AI knowledge base

■■ Keyboard Shortcuts

Shortcut	Action
Tab or +	Open node panel
Ctrl/Cmd + S	Save workflow
Ctrl/Cmd + E	Execute workflow
Ctrl/Cmd + Z	Undo
Ctrl/Cmd + C/V	Copy/Paste nodes
Delete	Delete selected node
D	Disable/Enable node
F	Add sticky note
Ctrl/Cmd + A	Select all nodes
Space (drag)	Pan canvas

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■ Automate everything with n8n!