# Create question answering solutions with Azure AI Language

The question answering capability of the Azure AI Language service makes it easy to build applications in which **users ask questions using natural language and receive appropriate answers**.

## Learning objectives

After completing this module, you will be able to:

- Understand question answering and how it compares to language understanding.
- Create, test, publish, and consume a **knowledge base**.
- Implement **multi-turn conversation** and **active learning**.
- Create a question answering bot to interact with using natural language.

## Introduction

A common pattern for "intelligent" applications is to enable users to ask questions using natural language, and receive appropriate answers. In effect, this kind of solution brings **conversational intelligence to a traditional frequently asked questions (FAQ) publication**.

In this module, you will learn how to use Azure AI Language to **create a knowledge base of question and answer pairs** that can support an application or bot.

After completing this module, you'll be able to:

- Understand question answering and how it compares to language understanding.
- Create, test, publish and consume a knowledge base.
- Implement multi-turn conversation and active learning.
- Create a question answering bot to interact with using natural language.

# Understand question answering

**Azure AI Language** includes a question answering capability, which enables you to define **a knowledge base of question and answer pairs** that can be queried using natural language input. The knowledge base can be published to a REST endpoint and consumed by client applications, commonly bots.

The knowledge base can be created from existing sources, including:

- **Web sites containing frequently asked question (FAQ) documentation**.
- Files containing structured text, such as brochures or user guides.
- Built-in chit chat question and answer pairs that encapsulate common conversational exchanges.

> Note: The question answering capability of Azure AI Language is a newer version of the QnA Service, which still exists as a standalone service. To learn how to migrate a QnA Maker knowledge base to Azure AI Language, see the migration guide.

# Compare question answering to Azure AI Language understanding

**A question answering knowledge base is a form of language model, which raises the question of when to use question answering**, and **when to use the conversational language understanding capabilities of Azure AI Language**.

The two features are similar in that they both enable you to define a language model that can be queried using natural language expressions. However, there are some differences in the use cases that they are designed to address, as shown in the following table:

| | Question answering | Language understanding |
|---|---|---|
| Usage pattern | User submits a question, expecting an answer | User submits an utterance, expecting an appropriate response or action |
| Query processing | Service uses natural language understanding to match the question to an answer in the knowledge base | Service uses natural language understanding to interpret the utterance, match it to an intent, and identify entities |

|  | Question answering | Language understanding |
|---|---|---|
| Response | Response is **a static answer to a known question** | Response indicates the most likely intent and referenced entities |
| Client logic | Client application typically presents the answer to the user | Client application is responsible for performing appropriate action based on the detected intent |

The two services are in fact complementary. You can build **comprehensive natural language solutions that combine language understanding models and question answering knowledge bases**.

# Create a knowledge base

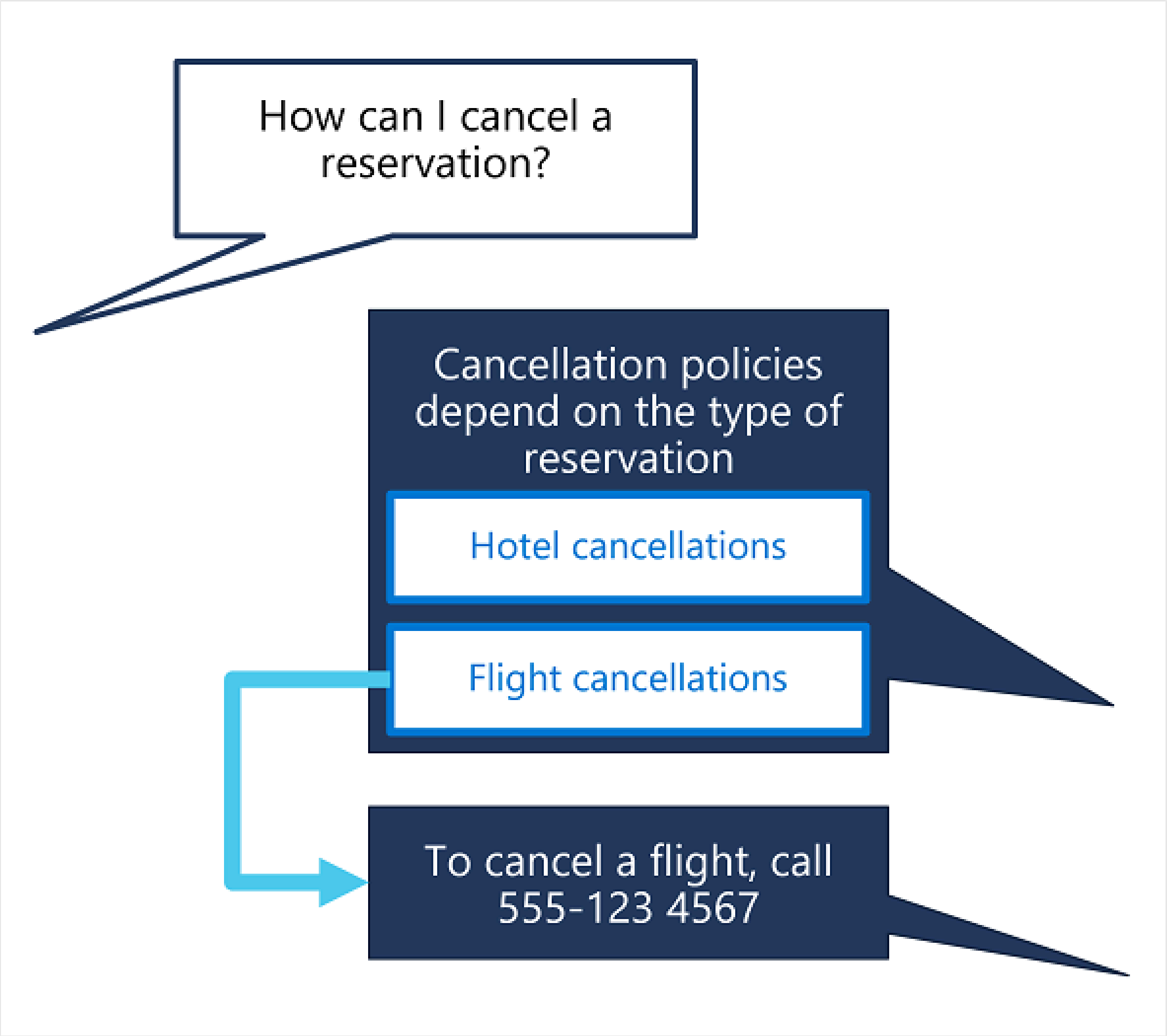
To create a question answering solution, you can use the REST API or SDK to write code that defines, trains, and publishes the knowledge base. However, it's more common to use the Language Studio web interface to define and manage a knowledge base.

To create a knowledge base you:

1. Sign in to Azure portal.
2. Search for Azure AI services using the search field at the top of the portal.
3. Select Create under the Language Service resource.
4. Create a resource in your Azure subscription:
   - Enable the question answering feature.
   - Create or select an Azure AI Search resource to host the knowledge base index.
5. In Language Studio, select your Azure AI Language resource and create a Custom question answering project.
6. Add one or more data sources to populate the knowledge base:
   - URLs for web pages containing FAQs.
   - Files containing structured text from which questions and answers can be derived.
   - Predefined chit-chat datasets that include common conversational questions and responses in a specified style.
7. Edit question and answer pairs in the portal.

# Implement multi-turn conversation

Although you can often create an effective knowledge base that consists of individual question and answer pairs, sometimes you might need to **ask follow-up questions to elicit more information from a user before presenting a definitive answer**. This kind of interaction is referred to as a **multi-turn conversation**.


How can I cancel a reservation?
Cancellation policies depend on the type of reservation
Hotel cancellations
Flight cancellations
To cancel a flight, call 555-123 4567

You can **enable multi-turn responses when importing questions and answers from an existing web page or document based on its structure**, or you **can explicitly define follow-up prompts and responses for existing question and answer pairs**.

For example, suppose an initial question for a travel booking knowledge base is "How can I cancel a reservation?". A reservation might refer to a hotel or a flight, so a follow-up prompt is required to clarify this detail. The answer might consist of text such as "Cancellation policies depend on the type of reservation" and include follow-up prompts with links to answers about canceling flights and canceling hotels.

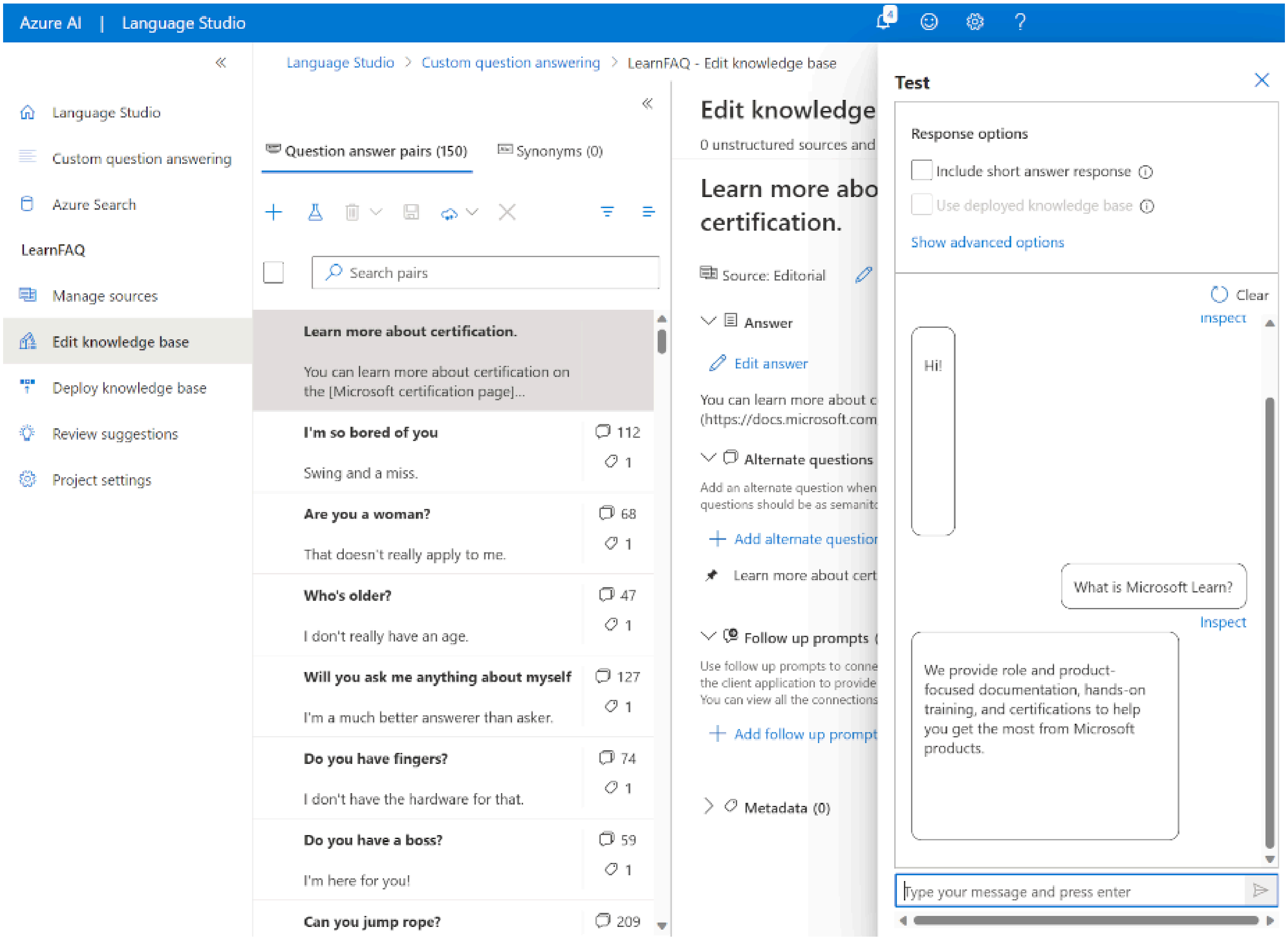
**When you define a follow-up prompt for multi-turn conversation, you can link to an existing answer in the knowledge base or define a new answer specifically for the follow-up**. You can also restrict the linked answer so that it is only ever displayed in the context of the multi-turn conversation initiated by the original question.

# Test and publish a knowledge base

After you have defined a knowledge base, you can train its natural language model, and test it before publishing it for use in an application or bot.

## Testing a knowledge base

You can test your knowledge base interactively in Language Studio, submitting questions and reviewing the answers that are returned. You can inspect the results to view their confidence scores as well as other potential answers.



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**I'm so bored of you** 112 1
Swing and a miss.

**Are you a woman?** 68 1
That doesn't really apply to me.

**Who's older?** 47 1
I don't really have an age.

**Will you ask me anything about myself** 127 1
I'm a much better answerer than asker.

**Do you have fingers?** 74 1
I don't have the hardware for that.

**Do you have a boss?** 59 1
I'm here for you!

**Can you jump rope?** 209

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Add an alternate question when questions should be as semantic

Learn more about cert

Use follow up prompts to conne the client application to provide You can view all the connections

□ Include short answer response
□ Use deployed knowledge base

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## Deploying a knowledge base

When you're happy with the performance of your knowledge base, you can **deploy it to a REST endpoint** that client applications can use to submit questions and receive answers. You can deploy it directly from **Language Studio**.

# Use a knowledge base

To consume the published knowledge base, you can use the REST interface.

The minimal request body for the function contains a question, like this:

```
{
  "question": "What do I need to do to cancel a reservation?",
  "top": 2,
  "scoreThreshold": 20,
  "strictFilters": [
    {
      "name": "category",
      "value": "api"
    }
  ]
}
```

| Property | Description |
|---|---|
| `question` | Question to send to the knowledge base. |
| `top` | Maximum number of answers to be returned. |
| `scoreThreshold` | *Score threshold for answers returned*. |
| `strictFilters` | Limit to only answers that contain the specified metadata. |

The response includes the closest question match that was found in the knowledge base, along with the **associated answer**, the **confidence score**, and other metadata about the question and answer pair:

```json
{
  "answers": [
    {
      "score": 27.74823341616769,
      "id": 20,
      "answer": "Call us on 555 123 4567 to cancel a reservation.",
      "questions": [
        "How can I cancel a reservation?"
      ],
      "metadata": [
        {
          "name": "category",
          "value": "api"
        }
      ]
    }
  ]
}
```

# Improve question answering performance

After creating and testing a knowledge base, you can **improve its performance with active learning and by defining synonyms**.

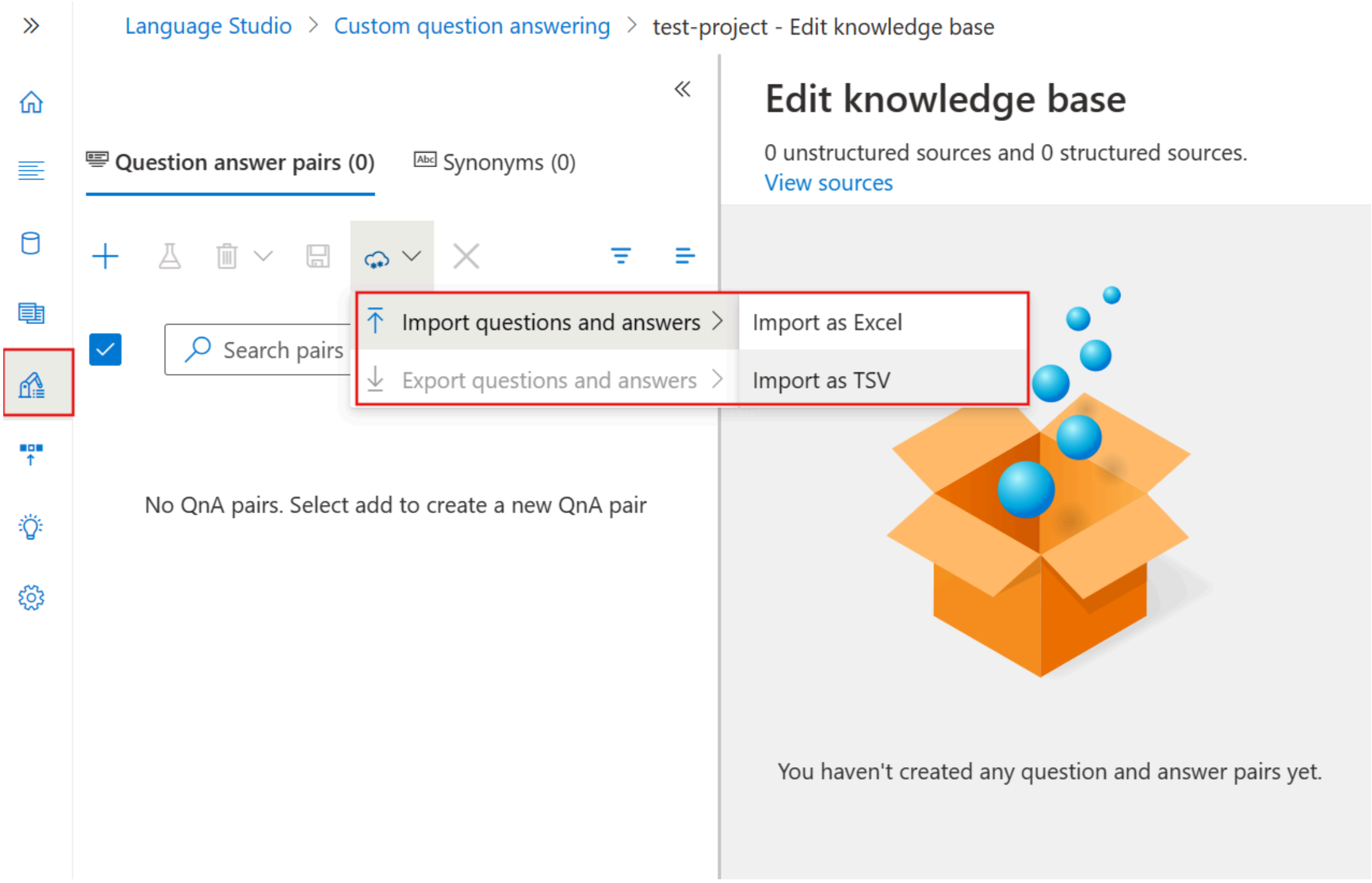
## Use active learning

Active learning can help you make continuous improvements to get better at answering user questions correctly over time. **People often ask questions that are phrased differently, but ultimately have the same meaning**. Active learning can help in situations like this because it enables you to consider alternate questions to each question and answer pair. Active learning is enabled by default.

To use active learning, you can do the following:

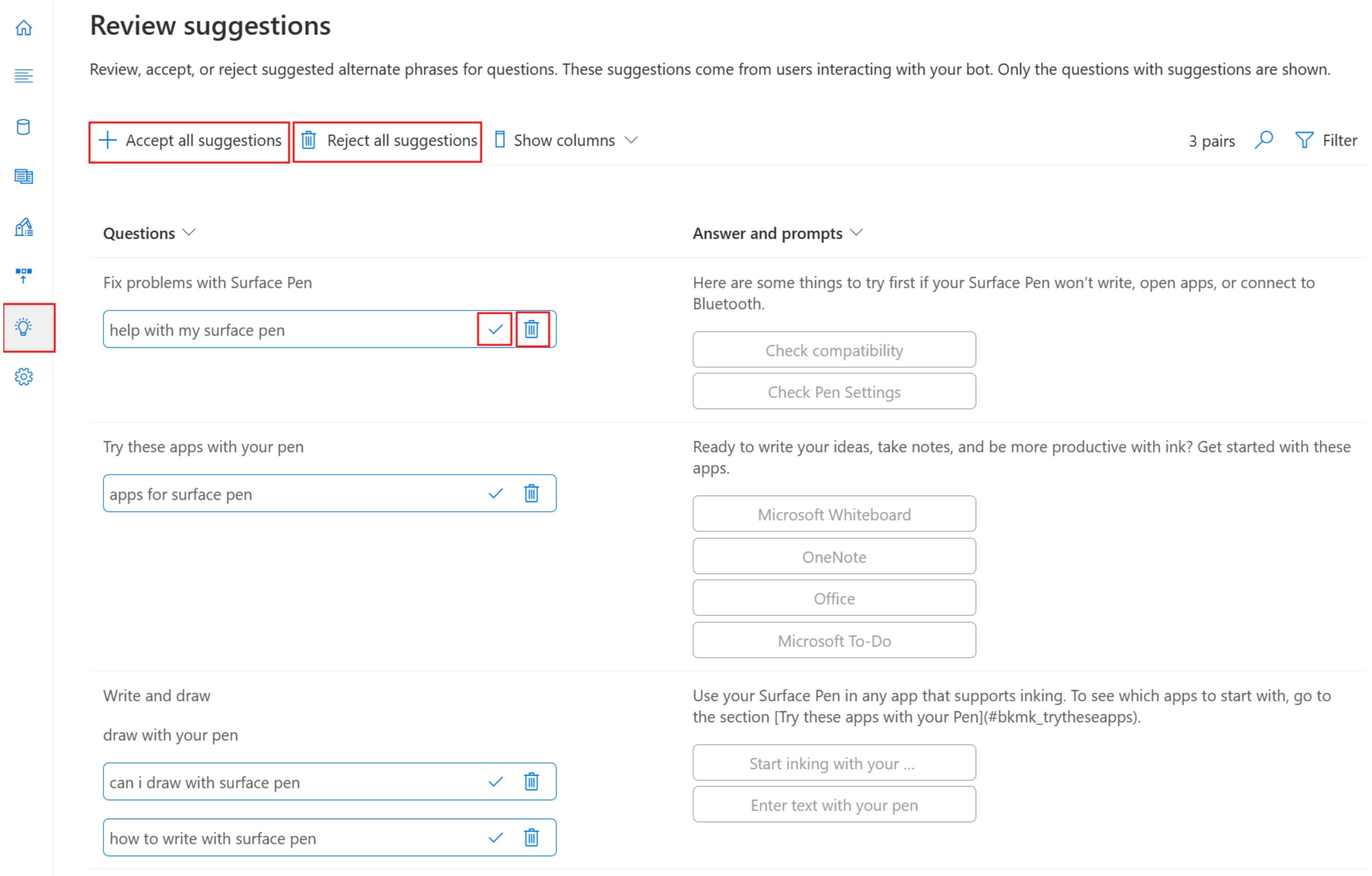
### Create your question and answer pairs

You create pairs of questions and answers in Language Studio for your project. You can also import a file that contains question and answer pairs to upload in bulk.


Language Studio > Custom question answering > test-project - Edit knowledge base
Question answer pairs (0)
Synonyms (0)
Search pairs
Import questions and answers
Export questions and answers
Import as Excel
Import as TSV
No QnA pairs. Select add to create a new QnA pair
Edit knowledge base
0 unstructured sources and 0 structured sources.
View sources
You haven't created any question and answer pairs yet.

## Review suggestions

Active learning then begins to offer alternate questions for each question in your question and answer pairs. You access this from the Review suggestions pane:



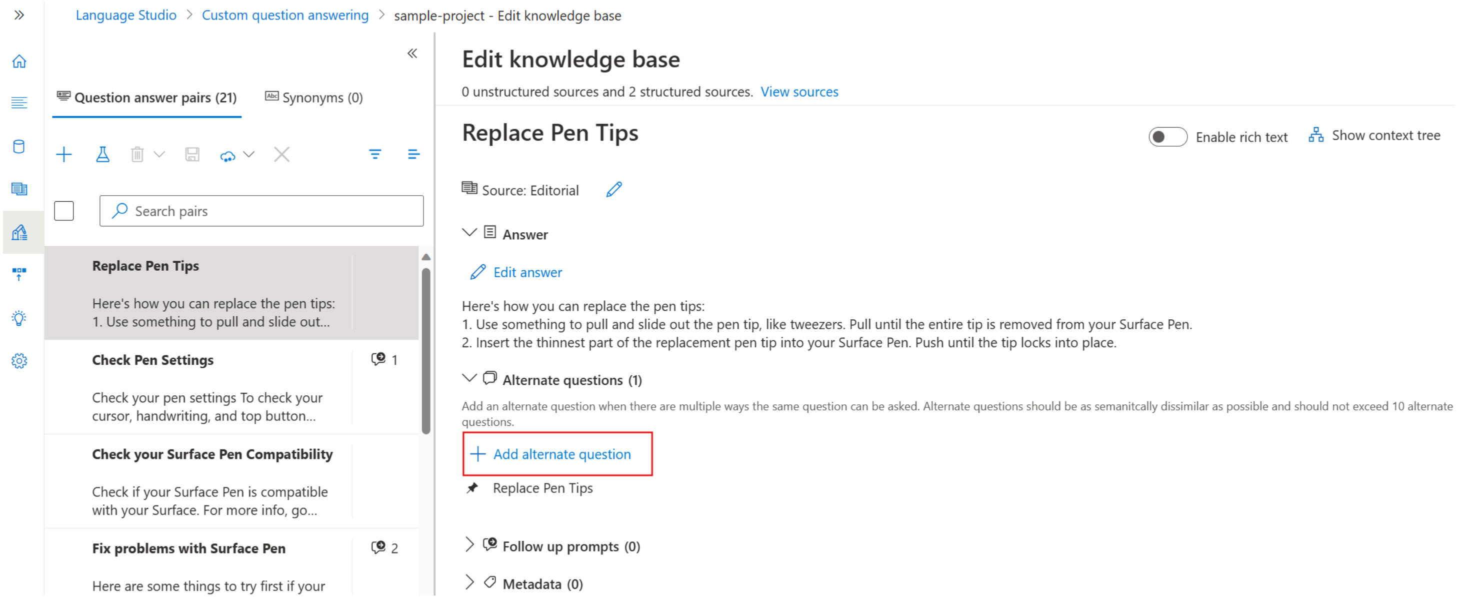
## Review suggestions

Review, accept, or reject suggested alternate phrases for questions. These suggestions come from users interacting with your bot. Only the questions with suggestions are shown.

| Questions | Answer and prompts |
|---|---|
| Fix problems with Surface Pen<br>help with my surface pen | Here are some things to try first if your Surface Pen won't write, open apps, or connect to Bluetooth.<br>Check compatibility<br>Check Pen Settings |
| Try these apps with your pen<br>apps for surface pen | Ready to write your ideas, take notes, and be more productive with ink? Get started with these apps.<br>Microsoft Whiteboard<br>OneNote<br>Office<br>Microsoft To-Do |
| Write and draw<br>draw with your pen<br>can i draw with surface pen<br>how to write with surface pen | Use your Surface Pen in any app that supports inking. To see which apps to start with, go to the section [Try these apps with your Pen](#bkmk_trytheseapps).<br>Start inking with your ...<br>Enter text with your pen |

You review, and then accept or reject these alternate phrases suggested for each question by selecting the checkmark or delete symbol next to the alternate phrase. You can bulk accept or reject suggestions using the Accept all suggestions or Reject all suggestions option at the top.

You can also manually add alternate questions when you select Add alternate question for a pair in the Edit knowledge base pane:


Language Studio > Custom question answering > sample-project - Edit knowledge base
Question answer pairs (21)
Synonyms (0)
Search pairs
Enable rich text
Show context tree
Edit answer
Add alternate question

Replace Pen Tips
Here's how you can replace the pen tips:
1. Use something to pull and slide out...

Check Pen Settings 1
Check your pen settings To check your cursor, handwriting, and top button...

Check your Surface Pen Compatibility
Check if your Surface Pen is compatible with your Surface. For more info, go...

Fix problems with Surface Pen 2
Here are some things to try first if your

### Edit knowledge base

0 unstructured sources and 2 structured sources. View sources

### Replace Pen Tips

Source: Editorial

Answer

Here's how you can replace the pen tips:
1. Use something to pull and slide out the pen tip, like tweezers. Pull until the entire tip is removed from your Surface Pen.
2. Insert the thinnest part of the replacement pen tip into your Surface Pen. Push until the tip locks into place.

Alternate questions (1)

Add an alternate question when there are multiple ways the same question can be asked. Alternate questions should be as semanitcally dissimilar as possible and should not exceed 10 alternate questions.

Replace Pen Tips

Follow up prompts (0)

Metadata (0)

> Note: To learn more about active learning, see Enrich your project with active learning.

## Define synonyms

Synonyms are useful when questions submitted by users might **include multiple different words to mean the same thing**. For example, a travel agency customer might refer to a "reservation" or a "booking". By defining these as synonyms, the question answering service can find an appropriate answer regardless of which term an individual customer uses.

To define synonyms, you **use the REST API to submit synonyms in the following JSON format**:

```
{
    "synonyms": [
        {
            "alterations": [
                "reservation",
                "booking"
                ]
        }
    ]
}
```

> Note: To learn more about synonyms, see the Improve quality of response with synonyms.

# Exercise - Create a question answering solution

## Create a Question Answering Solution

One of the most common conversational scenarios is providing support through a knowledge base of frequently asked questions (FAQs). Many organizations publish FAQs as documents or web pages, which works well for a small set of question and answer pairs, but large documents can be difficult and time-consuming to search.

**Azure AI Language** includes a question answering capability that enables you to create a knowledge base of question and answer pairs that can be queried using natural language input, and is most commonly used as a resource that a bot can use to look up answers to questions submitted by users.

# Module assessment

1. You want to create a knowledge base from an existing FAQ document. What should you do? Create a new knowledge base, importing the existing FAQ document.
2. How can you add a multi-turn context for a question in an existing knowledge base? Add a follow-up prompt to the question.
3. How can you enable users to use your knowledge base through email? Create a bot based on your knowledge base and configure an email channel.

# Summary

In this module, you have learned how to use the question answering capability of Azure AI Language to create a knowledge base of question and answer pairs that can support an application or bot.

Now that you've completed this module, you can:

- Understand **question answering** and how it compares to **language understanding**.
- Create, test, publish and consume a **knowledge base**.
- Implement **multi-turn conversation** and **active learning**.
- Create a **question answering bot** to interact with using natural language.

To learn more about the question answering capability of Azure AI Language, see the Question answering documentation.