



7.3 Fetching a ball

What this lesson is about

See it, approach it, grip it, bring it home.

- Find it
- Approach and grip
- Bring it home

Questions

7 marks in all

1. Put the stages of a fetch in order.

[1 mark]

Number the lines 1 to 5 to put them in the right order.

- ___ Stop and close the jaws once the ball is in reach
- ___ Steer towards the blob, slowing as distance() falls
- ___ Open the jaws
- ___ Spin until a red blob is in view
- ___ Drive home with go_to, holding the ball

Answer:

```
Spin until a red blob is in view
Steer towards the blob, slowing as distance() falls
Stop and close the jaws once the ball is in reach
Drive home with go_to, holding the ball
Open the jaws
```

Find it, go to it, grip it, bring it home, let go. Each stage is something from an earlier lesson.

2. What does this program print?

[1 mark]

```
def bearing_of(cx):
    return (cx - 160) * 120 / 320

print(bearing_of(240))
print(bearing_of(100))
```

Answer:

```
30.0
-22.5
```

The picture is 320 pixels across a 120 degree view, centred on 160. 240 is 80 pixels right, 30 degrees; 100 is 60 pixels left, -22.5 degrees.

3. What does this program print?

[1 mark]

```
for d, error in [(30, 4), (30, 25), (8, 2)]:  
    speed = 15 if d < 10 else (45 if abs(error) < 10 else 20)  
    print(d, error, speed)
```

Answer:

```
30 4 45  
30 25 20  
8 2 15
```

Far and centred gets 45, far but still turning gets 20, and anything under 10 cm gets 15 whatever the error.

4. Why does `fetch` slow to 15 for the last few centimetres?

[1 mark]

- ☐ A The slow finish is what makes the grip reliable
- ☐ B The distance sensor only works at low speed
- ☐ C The jaws cannot close while the robot is moving
- ☐ D To save the battery for the drive home

Answer: A. Arrive fast and the ball gets nudged away or overshoot. Arrive slowly and it is still there when the jaws close.

5. Inside `fetch`, the jaws close but `holding()` is `None`. What happens next?

[1 mark]

- ☐ A It creeps forward at 15 and tries again on a later tick
- ☐ B It returns `False` straight away
- ☐ C It opens the jaws and spins to search again
- ☐ D It returns `True` anyway

Answer: A. A missed grip means the ball was just out of reach, so the loop moves a little closer and keeps going.

6. `fetch` has used all 250 ticks without holding the ball. What does it do?

[1 mark]

- ☐ A Stops the motors and returns `False`
- ☐ B Returns `True`
- ☐ C Starts the 250 ticks again
- ☐ D Keeps driving forward at 15

Answer: A. After the loop, `stop()` then `return False`: the caller can tell the fetch failed.

7. `fetch` waits 0.1 s each tick for up to 250 ticks. Ignoring the time spent gripping, what is the longest it can take, in whole seconds?

[1 mark]

Answer: 25. $250 \times 0.1 = 25$ seconds, so a fetch can never hang forever.

The task: fetch the ball

Find the red ball, fetch it, and leave it in the home zone.

Any program that meets the task's checks is marked correct in the simulator; this is one way, not the only way.

