Solution Pathway

NOTE: This task is sold on condition that it is NOT placed on any school network or social media site (such as Facebook, Wikispaces, etc.) at any time. NOT FOR PRIVATE TUTOR USE.

Below are sample answers. Please consider the merit of alternative responses.

SECTION A – Multiple-choice question

Question	Answer	Comments
1	D	Many results would contain decimal answers
2	A	Jeanie is conducting usability testing as she is working with potential users
3	A	
4	A	
5	D	Iteration is a loop, such as the for-end for loop. All lines are sequential.
6	D	
7	B	A class will always have a constructor method (even if one is not defined by the programmer, a default constructor will always be created by the compiler or interpreter)
8	A	
9	C	
10	B	
11	C	Employees will have the most accurate information about their current practices. Often the employer will know what "should" happen, but the employees know what "does" happen.
12	B	While it is not necessary to consult clients during the design stage, it is often a good idea.
13	C	A could be considered a FR, however it is better described as a constraint. B is maintainability and D is non-functional (validation)
14	C	The others are efficiency measures
15	A	While reasonableness may be a factor (e.g. if the due date is in the holidays), accuracy is a better response
16	C	
17	B	17 mod 4 = 1, so the 17 goes in the second slot in the 1 array, after 5
18	A	Archiving involves deleting the original, version control manages differences between different copies of the code. Back up is a case a good management, rather than luck
19	D	All others are software security controls

20	*B*	

SECTION B – Short-answer questions

Question 1 (3 marks)

Hannah is creating a small software solution for a client who has a tight deadline to work to and is quite clear about what the solution should do. Identify which development model approach would best suit her project and justify why it would be preferred over another model?

Model: Waterfall

Justification: Waterfall is best suited to projects with clear requirements and tight deadlines, as in this case. Spiral (or agile) models are often about continuous feedback from the client about improvements and functionality. As we already know the requirements this is not a factor. Agile can take longer to produce the final solution due to the feedback loop. Spiral is a risk-minimisation strategy, much more suitable to a larger project.

1 mark is awarded for stating waterfall.
1 mark for stating advantages for waterfall.
1 mark for stating why either spiral or agile are less preferred.

Question 2 (3 marks)
Sandra is creating a data dictionary for a software solution she is working on.

a.   Describe one convention she should follow when determining the names of her variables? 1 mark
     camelCase, meaningful names, consistency, Hungarian notation, snake_case

b.   Apart from the name, what other information is important for Sandra to include in the data
     dictionary?   2 marks
     Data type, purpose/description

1 mark for a suitable convention.
2 marks for two pieces of relevant information. VCAA exams consistently use these two in exams, however other elements such as scope, format, size/length should be accepted.

Question 3 (5 marks)

A golf club holds a member competition every Saturday. The player, or players, with the lowest score wins the competition. The club needs to determine the winner(s) from an associative array of called *scores* with players name as the key and players score as the value and output the winner's name(s) as an array and the winning score.

begin

        input scores[]

        winnerNames = [ ]

        winnerScore = 999

        foreach scores **as** score

                if score.value = winnerScore **then**

                        winnerNames[ ] ← score.key

                elseif score.value < winnerScore **then**

                        winnerScore ← score.value

                        clear winnerNames[]

                        winnerNames[ ] ← score.key

                endif

        endforeach

        output winnerNames, winnerScore

end

1 mark is awarded for foreach loop (note it could also be written with a for loop, by using count (scores).

1 mark is awarded for if-then-elseif-endif structure.

1 mark is awarded for correctly assigning the score and names to winner variables.

1 mark is awarded for clearing the winnerNames array if we find a lower score.

1 mark is awarded for correct code indenting.

There are many ways to represent associative arrays/dictionaries in pseudocode. So long as the intention of the algorithm is clear and correct students should be awarded marks. Most answers would likely be related to a programming language. You should consider the examples you have provided your students. Below are how it might look in a few different programming languages:

PHP
```php
$scores = [];
$scores["Asan"] = 89;
$scores["Julie"] = 86;
$scores["Ethan"] = 90;
$scores["Bob"] = 86;
$scores["Charlotte"] = 91;

$winnerNames = [];
$winnerScore = 999;

foreach ($scores as $name => $score) {
    if ($score == $winnerScore) {
        $winnerNames[] = $name;
    }
    Elseif ($score < $winnerScore) {
        $winnerScore = $score;
        $winnerNames = [];
        $winnerNames[] = $name;
    }
}

echo "The winners are " .implode(",", $winnerNames). " with a score of $winnerScore";
```

VB.Net
```vbnet
Dim scores As New Dictionary(Of String, Integer)
scores.Add("Asan", 89)
scores.Add("Julie", 86)
scores.Add("Ethan", 90)
scores.Add("Bob", 86)
scores.Add("Charlotte", 91)

Dim lWinnerNames As List(Of String) = New List(Of String)
Dim winnerScore As Integer

winnerScore = 999

For Each score As KeyValuePair(Of String, Integer) In scores

    If score.Value = winnerScore Then
        lWinnerNames.Add(score.Key)
    ElseIf score.Value < winnerScore Then
        winnerScore = score.Value
        lWinnerNames.Clear()
        lWinnerNames.Add(score.Key)
    End If
Next

Dim winners As String = String.Join(",", lWinnerNames)
MsgBox("The winners are " + winners + " with a score of " + winnerScore.ToString)
```

Python
```python
scores = {}
scores["Asan"] = 89
scores["Julie"] = 86
scores["Ethan"] = 90
scores["Bob"] = 86
scores["Charlotte"] = 91

winnerNames = []
winnerScore = 999

for name, score in scores.items():
    if score < winnerScore:
        winnerScore = score
        winnerNames.clear()
        winnerNames.append(name)
    elif score == winnerScore:
        winnerNames.append(name)

winnersList = ",".join(map(str, winnerNames))
print ("The winners are " + winnersList + " with a score of " + str(winnerScore))
```
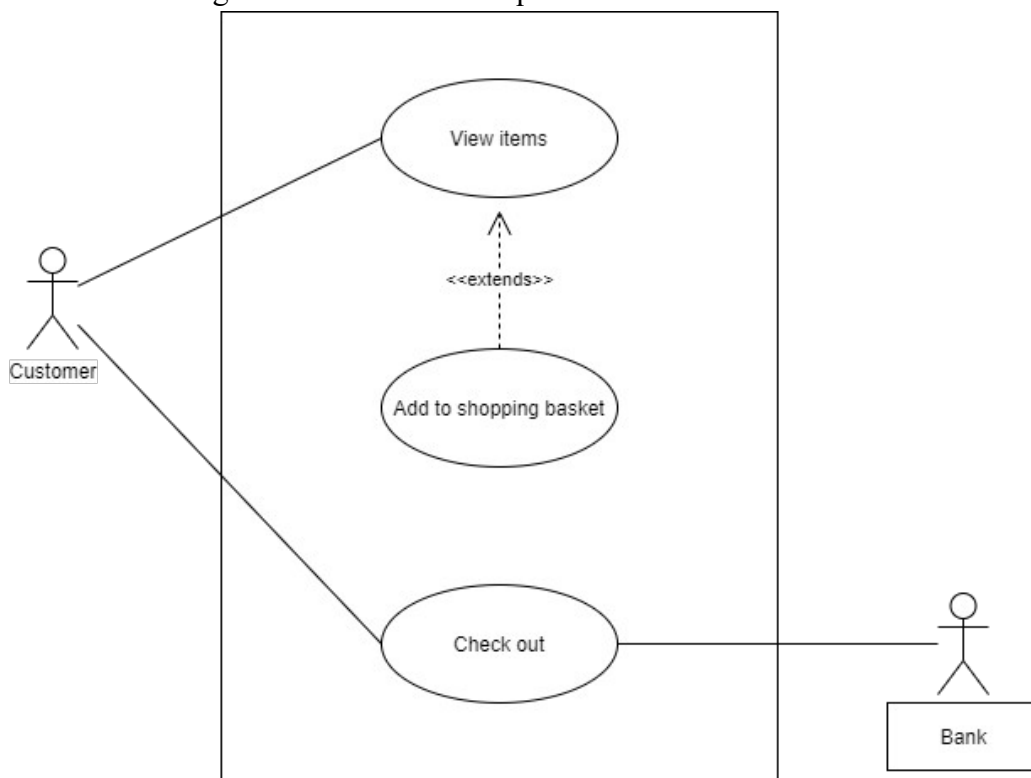
Question 4 (3 marks)

An online shopping system allows customers to view items in their catalogue and then add them to a shopping basket if they decide to purchase them. They can then purchase them securely through an online banking service.

Complete the Use Case diagram to reflect these requirements.

1 mark awarded for labelling the bank actor.

1 mark awarded for adding and labelling the "add to shopping basket" case (or similar).

1 mark awarded for making "add to shopping basket" an extends from "view items".

Question 5 (3 marks)

EyeSeeYou Optometrists collect a range of sensitive data about the clients and their physical health. Recently, an employee showed the network administrator a suspicious email they received that looked like it had come from the company but asked them to click a link and sign-in to a different program.

Identify the type of attack and outline a strategy the company should take to prevent any breaches of data in relation to this attack.

This is a phishing (or social engineering) attack.

The company should inform their employees of the specifics of this attack and instruct them on the correct course of action (i.e., deleting the email). They should also have regular employee training regarding different types of cyber-attacks and how to avoid them.

1 mark for identifying the type of attack.

2 marks for outlining a strategy, which should contain at least two steps.

Answers such as "tell them to delete it" are not sufficient on their own for two marks.

Question 6 (3 marks)

At the end of a development project, Sam and Sarah undertake an evaluation of their project plan. They identify several reasons why their initial plan changed over the course of the project including Sarah's laptop crashing and having to be replaced, Sam getting sick and not being able to work and their client adding requirements after the development stage had begun.

Describe one way that Sam and Sarah could record these changes and their impact on the project and discuss how it could help with future projects.

Sam and Sarah could update their Gantt chart, adjusting time for different tasks (and adding new ones if required) and updating the milestones for the project.

By reviewing the differences between their original plan and their final plan, they will be able to identify areas to focus on (such as back up equipment or better requirements planning) in future projects.

2 marks for a way to record changes to their plan AND their impacts.

1 mark for stating how this can improve future projects.

Students could also discuss a journal or log of changes.

SECTION C – Case study

Question 1 (6 marks)

Anthea is excited to start work on the app. However, she knows that such a large project requires careful management. She creates the following task list:

Task Number	Task Name	Duration	Dependency
1	Data collection	1 week	-
2	Analyse data	3 days	1
3	Complete SRS	4 days	2
4	Design interface and client sign off	1 week	3
5	Design data storage and algorithms	1 week	3
6	Develop therapist interface and data storage	4 weeks	4,5
7	Develop patient interface	4 weeks	6
8	Testing	2 weeks	7

a. Using the task list above, complete the following Gantt chart.   4 marks
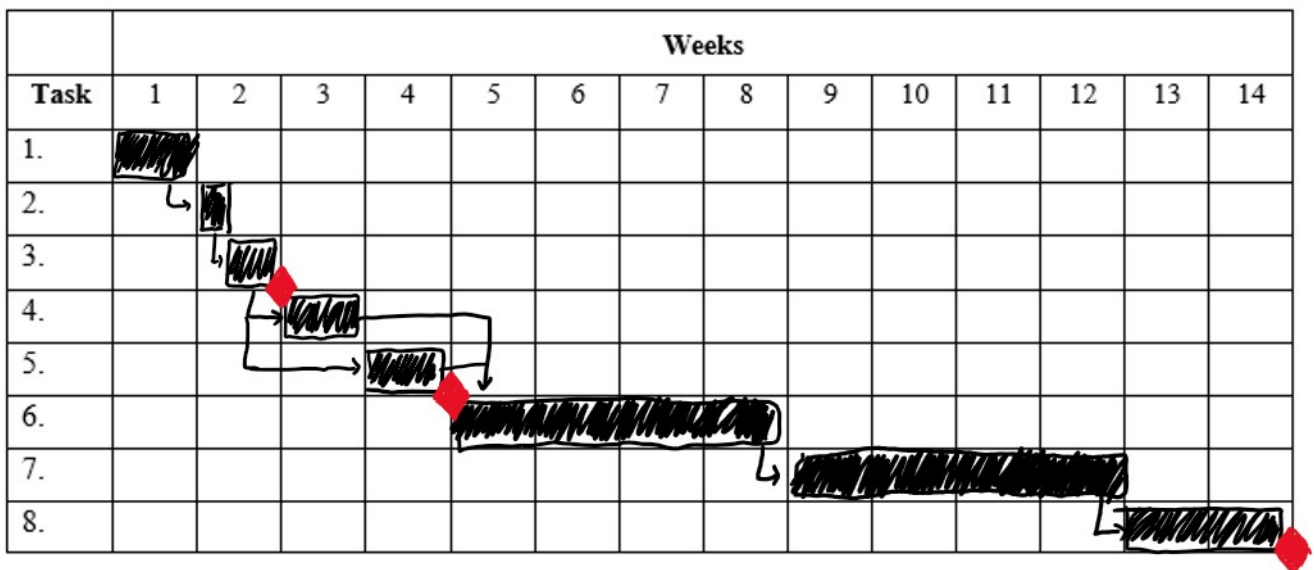
2 marks for correctly placing all tasks in the chart.
2 marks for correctly annotating all dependency arrows.

b. Identify two points in the project that would be considered milestones by marking them on the chart above.   2 marks

2 marks for placing a diamond shape (regardless of colour) in 2 of the identified places. These mark the end of the PSM stages for the project. Students could also place a milestone after Task 7.

Question 2 (6 marks)

Identify two different data collection techniques Anthea could use to determine the requirements for the project. For each technique, identify one piece of data she can collect and why this technique is the most appropriate in that instance.

Observation.
By watching the therapists using their current system, Anthea can see how they connect the exercises to the patient's needs. Observation can reduce therapist bias in discussions.

Reports.
By reviewing printouts or hand-written notes that are used currently, Anthea will see what her new system will need to achieve. It supports any discussions held with the therapists and can reduce confusion about intent.

Interview.
By speaking directly to the therapists, Anthea can gain deeper insight into their requirements by asking follow-up questions and clarifying her understanding.

Survey.
This would enable her to target a larger number of respondents. Anthea can ask the patients, former and current, of the service about their experience and seek a different perspective of the problem. She would need to consider privacy concerns.

1 mark for identifying 1 of these 4 techniques – they are the only ones listed in the study design.
1 mark for 1 piece of data to collect.
1 mark for 1 advantage of that technique appropriate for the circumstance.

Marks allocated this way for two responses. Students should not be awarded for repeating a technique, even if the data collected is different (i.e., two interviews).

Question 3 (2 marks)

Once she has analysed the data, Anthea identifies functional and non-functional requirements, constraints, and the scope for the project. To formalise her findings, Anthea produces a Software Requirements Specification (SRS). Apart from these components, what else should she include in the document?
- *System and technical requirements.*
- *Assumptions.*

2 marks for these 2 components. While an SRS can include many elements, students should refer specifically to those included in the study design.

From the Study Design – Glossary
Features of an SRS should include a description of the functional and non-functional requirements, system and technical requirements, constraints, scope and assumptions.

Question 4 (4 marks)

Therapists will use the patient email and data about exercises such as type and duration to create a program for each patient. Patients will receive their exercise program and update the system each time they complete their exercises.

Use this information and the context diagram provided to identify the labels in the Level 1 Data Flow Diagram below.
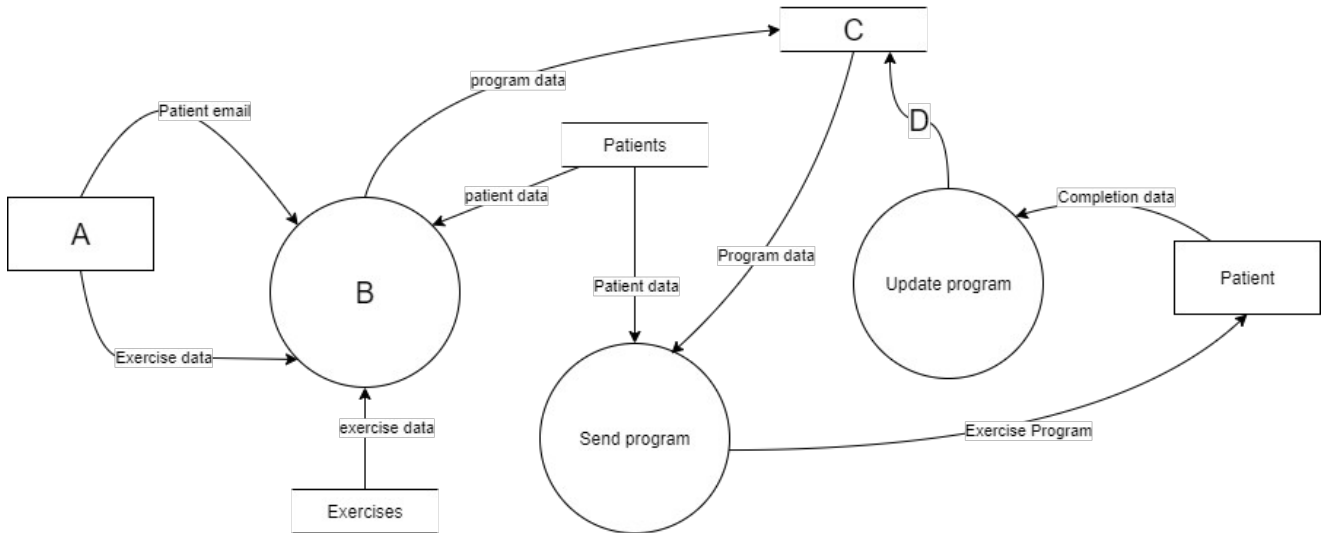
A *Therapist*
B *Create program*
C *Programs (or Patient programs)*
D *Updated program data*

1 mark for each correctly labelled component.

Question 5 (5 marks)

Seeing as she already has a data flow diagram, Anthea is considering whether she needs to create a use case diagram as well.

a.   Describe the purpose of a use case diagram   1 mark

   A use case diagram models how users interact with a system.

1 mark for stating that it involves users interacting with the system.

b.   Compare the stick figure used in a use case diagram to the rectangle used in a data flow diagram.   4 marks

   The stick figure in a UCD, called an actor, indicates the role a user (or other outside system) plays when interacting with the system. Whereas the rectangle in a DFD represents an external entity which sends data to and receives data from the system.

1 mark for stating the stick figure is called an actor.
1 mark for stating the actor plays a role and/or interacts with the system.

1 mark for stating the rectangle is called an external entity.
1 mark for stating an external entity sends and receives data to and from the system.

Question 6 (5 marks)

During the analysis phase several requirements were determined and from these Anthea created two alternative designs.

a.   Write two evaluation criteria to assist Anthea selecting between her alternate designs – one for efficiency and one for effectiveness.

Clients should be able to access their current exercise program easily (Efficiency – effort).
Clients should only be able to see their own exercise program (Effectiveness – accuracy/relevance).

1 mark for 1 valid evaluation criteria for efficiency.
1 mark for 1 valid evaluation criteria for effectiveness.

b.   Using the two criteria, justify which design you would recommend.

Both designs reference the user's name, indicating a login, which suggests users would only be able to see their own programs. While Design 1 shows the videos in the page, Design 2 shows the whole exercise program in one page, without clicking other tabs, which is more efficient. Therefore, Anthea should select Design 2.

1 mark for outlining how 1 criterion from part a) is impacted by the two designs.
1 mark for outlining how the other criterion from part a) is impacted by the two designs.
1 mark for making a choice based on the description of the criteria.

Students could select either design so long as their criteria logically lend to that conclusion.
Students can receive one mark for a reasonable answer that does not involve answers from part a.

Question 7 (3 marks)

Anthea's system will not have access to the clinic's patient data in their current system. Patients will create their own account in Anthea's system, and tell their physiotherapist their email address, which will then be entered in their patient data in the clinic's existing system. This will provide a unique identifier link between the two systems.

Identify the relevant legislation and discuss the implications for Phil and his practise in allowing Anthea to view their data.

Health Records Act 2001.
The legislation states that data collected must only be used by the service for the purpose it was collected for, or a related secondary purpose the person would reasonably expect.
While it may be legal that Anthea's system has access in this way, it is safer to keep the data separate and by only using the email address, rather than other identifiers such as Medicare numbers, it further safeguards patient data.

1 mark for correctly identifying the legislation.
1 mark for identifying that the data could be used in this way.
1 mark for discussing the improved safety of the data.

Question 8 (4 marks)
Anthea's system will send details of the patient's exercise program to the therapist's current system, using the email address to identify the patient. These will then be added to the patient's notes automatically as plain text. The existing system requires data to be in XML format.

a.   Explain why different systems use XML to transfer data.   2 marks
XML provides both the data to be transferred and the structure meaning that the two systems do not have to know the exact nature of the data. It also has the benefit that if the structure changes, the systems may not have to be updated.

1 mark for noting XML contains both data and structure.
1 mark for noting that extensible nature of the data.

b.   What validation would you expect the therapist's current system to implement before adding the notes to a patient's record?   2 marks

It would need to ensure the existence of the patient, via their email address.
1 mark for existence check.
1 mark for noting it is the email that must be found.

Question 9 (4 marks)
Before beginning her coding, Anthea decides to write pseudocode for some elements of the new system.

a.   Describe what pseudocode is.
A series of English-like statements used to represent an algorithm that will solve a problem.

1 mark for describing the "English-like" nature of pseudocode.
1 mark for stating that it is used to solve a problem.

b.   Suggest two reasons why a programmer would write pseudocode before beginning development.
Programmers use pseudocode to solve the logical problem without having to worry about the rigours of a formal programming language.
They could use it as they may not know which language they will eventually use.

2 marks for stating 2 valid reasons.

Question 10 (5 marks)

When patients are creating the account in the new system, their password is stored using a cryptographic hash algorithm, which ensures it is virtually impossible to crack.

When patients then login to the system, the login function checks a `userArray` for the email address and, if found, compares the stored password (which is already hashed) with the return value of a `hashPassword` function. If the username and hashed password match, the function returns TRUE. If either the email address is not found, or the passwords do not match, the function returns FALSE.

The login procedure requires the following information:
- Patient email address (for username)
- Patient password (entered by the user)
- Stored user details in an array of objects with
  - email
  - password (secured with a cryptographic hash algorithm)

  The object description is below:

  Object: User

Property Name	Data Type	Description
email	string (255)	
password	string (128)	stored hashed password

Complete the algorithm in pseudocode in the space provided.

begin
{check password function}

       input email, password
       input userArray
       hashedPassword ← hashPassword(password)

```
        for i ← 0 to length(userArray) -1
                if userArray[0].email = email then
                        if userArray[0].password = hashedPassword  then
                                return TRUE
                        else
                                return FALSE
                        endif
                endif
        endfor
        return FALSE
```

end

1 mark for the use of a for loop (could also use a for Each).
1 mark for checking input email against email in object.
1 mark for comparing stored password against hassPassword.
1 mark for returning correctly in all three cases.

- • TRUE if both match.
- • FALSE if email not found.
- • FALSE if email found, but passwords do not match.
- 1 mark for correct indenting.

Question 11 (5 marks)

When the physiotherapists look at their patient data, they want a quick view of whether the patient has marked all activities set since the previous consultation as completed.

Anthea wrote the following algorithm which receives an array of all activities scheduled for a patient since their last visit and their status (complete = TRUE or complete = FALSE).

```
begin
{check all complete function}
        input userActivities
        allComplete ← FALSE

        for i ← 0 to count(userActivities)
                if userActivities[i].complete = TRUE then
                        allComplete ← TRUE
                else
                        allComplete ← FALSE
                endif
        endfor
        return allComplete
end
```

a.   Anthea created the following test data to check her algorithm.
Complete the table of expected and actual results.   3 marks

Test data	Expected result	Actual result
userActivity.complete = [TRUE, TRUE, TRUE]	TRUE	TRUE
userActivity.complete = [TRUE, TRUE, FALSE]	*FALSE*	*FALSE*
userActivity.complete = [FALSE, TRUE, TRUE]	*FALSE*	*TRUE*
userActivity.complete = [FALSE, FALSE, FALSE]	*FALSE*	*FALSE*

1 mark for each correct ROW in the table (i.e., both expected and actual are correct).

b.   Describe the logic error contained in Anthea's algorithm.   2 marks
Regardless of how many exercises the patient completes, if they have done (or not done) the last exercise in the list that is what is returned, whereas it should only return TRUE if all exercises are completed.

1 mark for stating how the algorithm does work.
1 mark for stating how it should work.

Question 11 (6 marks)

Anthea has nearly completed the solution and now needs to conduct usability testing.

a.   Explain how usability testing differs from other testing Anthea has completed for the
solution.   2 marks
Usability testing involves actual or potential users trying out the program, whereas up until this point Anthea has done the testing herself.

1 mark for stating that usability testing involves users (or involves a fixed plan)
1 mark for contrasting that with Anthea's testing while in development (ad-hoc or testing tables by the developer)

b.   Using the prompts below complete two usability test plans by briefly describing the
purpose of one test and how feedback will be collected for each user type.   4 marks

User – Therapist
Purpose of the test
To determine if the therapist can easily add a link to a video for an exercise.

How feedback will be collected
After completing the test, the therapist will complete a survey and rate the ease with which they were able to find and connect the relevant video to the exercise plan.

User – Patient
Purpose of the test
To determine if the user can successfully mark their exercises as complete.

How feedback will be collected
Anthea will observe the patient using the software and record if they could successfully mark an exercise as complete.

1 mark for an appropriate test and 1 mark for an appropriate and valid data collection technique for each user type.

Question 12 (5 marks)
Having successfully delivered the software solution to Phil, Anthea is preparing to evaluate her solution.

a.   How long Anthea should wait before conducting the evaluation. Justify your response.   2 marks
Anthea should wait at least a month before beginning her evaluation of the solution.
This is to allow a full cycle of the program (first visit to next visit) for a range of different patients and therapists

1 mark for stating a period of time (between a month and 6 months is appropriate).
1 mark for noting this allows all phases of the solution to be used and by a range of different users.

b.   Describe a strategy that Anthea could implement to evaluate her solution.   3 marks
Create a survey that users can complete about their experience.
Email the users, collect, and analyse their responses.
Compare responses to the evaluation criteria generated during design.

1 mark for linking their strategy to evaluation criteria.
1 mark for stating how data will be collected.
1 mark for multiple steps.

Students could also collect data by interviewing therapists or patients.