

Affix label with Candidate Code
Number here.
If no label, enter candidate
Number if known

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No. 9195



Plumbers,
Gasfitters and
Drainlayers Board

CRAFTSMAN EXAMINATION, NOVEMBER 2007 PLUMBING

QUESTION AND ANSWER BOOKLET

Time allowed THREE hours

INSTRUCTIONS

Check that the Candidate Code Number on your admission slip is the same as the number on the label at the top of this page.

Do not start writing until you are told to do so by the Supervisor.

Total marks for this examination: 100.

The pass mark for this examination is 60 marks.

Write your answers and draw your sketches in this booklet. If you need more paper, ask the Supervisor for extra sheets. Write your Candidate Code Number and the number 9195 on any extra sheets used, and attach them to this booklet. **NO SEPARATE ANSWER BOOKLET IS TO BE USED.** Write the number of extra sheets used in the box on the last page of this booklet. Write NIL if you have not used any.

All working in calculations must be shown.

Candidates are permitted to use the following in this examination:

Drawing instruments, approved calculators

The following are NOT permitted in the examination room:

Any publications, Acts, Regulations, Codes of Practice, or Standards

Check that this booklet has all of 16 pages in the correct order and that none of these pages is blank.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION

QUESTION 1

(a) State THREE limitations that are placed, under the Building Act, on an Independently Qualified Person (IQP) involved with backflow prevention.

- 1 _____
- 2 _____
- 3 _____

(3 marks)

(b) Give the number and the name of FIVE standards that could be considered when a plumbing system is being designed.

- 1 _____
- 2 _____
- 3 _____
- 4 _____
- 5 _____

(5 marks)

(c) Give TWO examples of people who are legally entitled to connect and disconnect electrical wiring from an isolating switch to a hot water cylinder.

- 1 _____
- 2 _____

(1 mark)

Total 9 marks

QUESTION 2

A building is to be used for community care. A high level cold water storage tank is to be installed in the building. List EIGHT factors that must be considered when designing the installation so that it complies with New Zealand Building Code clause G12/AS1.

1 _____

2 _____

3 _____

4 _____

5 _____

6 _____

7 _____

8 _____

Total 8 marks

QUESTION 3

(a) A pump is required to supply water from a storage tank to a dwelling. List FIVE items of information, other than cost, required to make the correct pump selection.

- 1 _____
- 2 _____
- 3 _____
- 4 _____
- 5 _____

(5 marks)

(b) A cylindrical water storage tank requires cleaning out and disinfecting. The tank has a diameter of 3.2m, and the standing water level is 2.4m. The rate of disinfecting agent to be used is 5g/m³ of water.

Calculate how much disinfecting agent will have to be added to the tank water.

(2 marks)

(c) (i) State the maximum theoretical depth that water can be raised from below ground (suction lift) by a pump at ground level.

(ii) State TWO factors that may affect the suction lift achieved.

- 1 _____
- 2 _____

(iii) State what must be done when the suction lift required is greater than practical lift achievable.

(4 marks)

QUESTION 3 (cont'd)

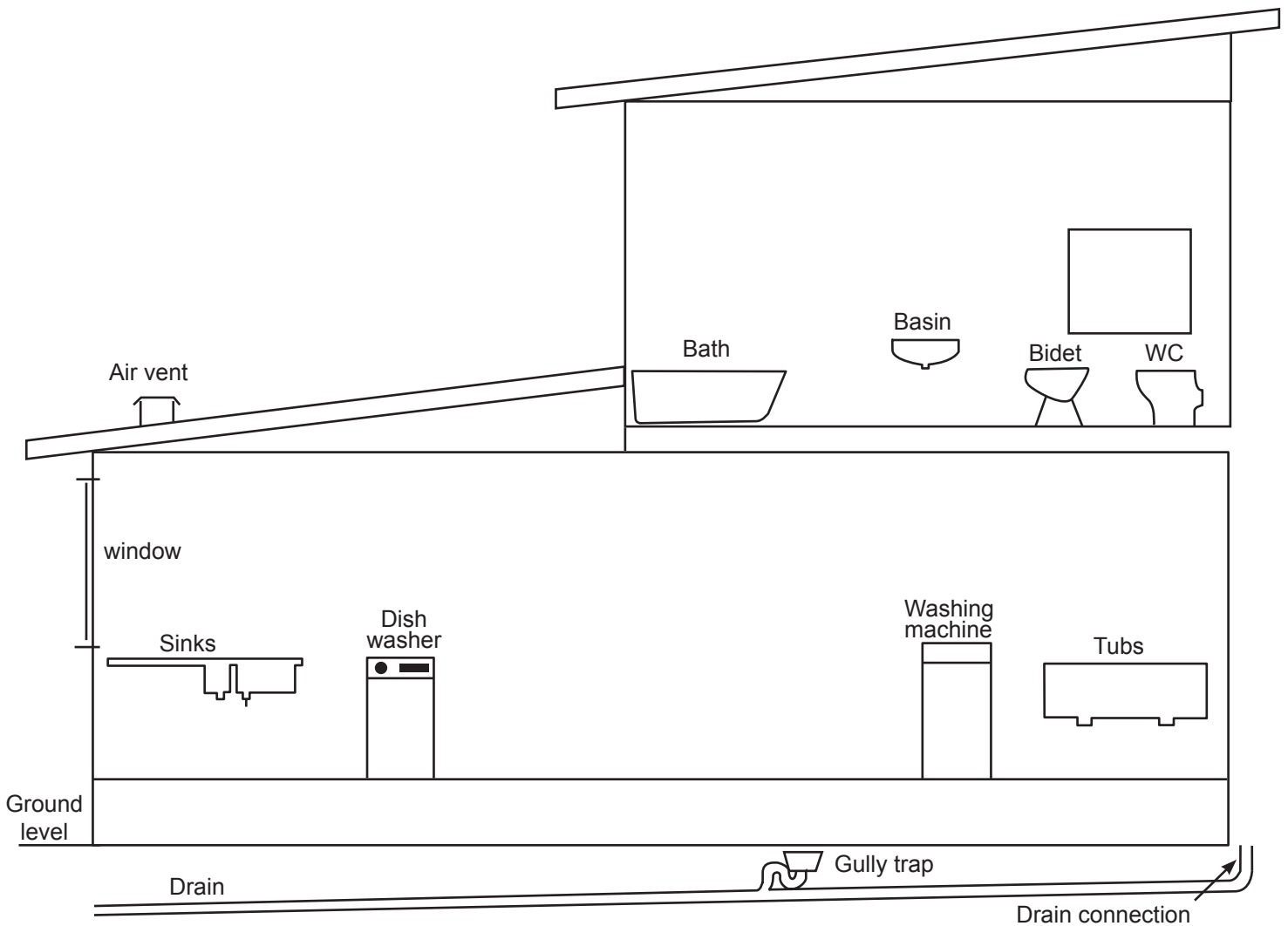
- (d) State the functional requirement of water supplies within a building as set out in the first schedule of the Building Regulations.

(1 mark)

Total 12 marks

QUESTION 4

The diagram below shows an elevation of a bathroom, laundry and kitchen.



Using your knowledge of New Zealand Building Code G13/AS1, complete the drawing to show the foul water and ventilating pipework.

Use open vents only, and do not use air admittance valves.

Total 7 marks

QUESTION 5

The diagram opposite shows a cold water pipework layout in a commercial building. Mechanical backflow preventers are required to protect the potable water supply.

(a) On the diagram, show the position of all required backflow prevention devices.

(4 marks)

(b) On the diagram, show the degree of hazard being protected by each backflow device.

(4 marks)

(c) On the diagram, show the minimum type of mechanical backflow prevention device being used for each hazard application.

(4 marks)

(d) State the purpose of air-gap separation in a domestic plumbing system, and state the minimum air-gap required.

Purpose: _____

Minimum air gap: _____

(2 marks)

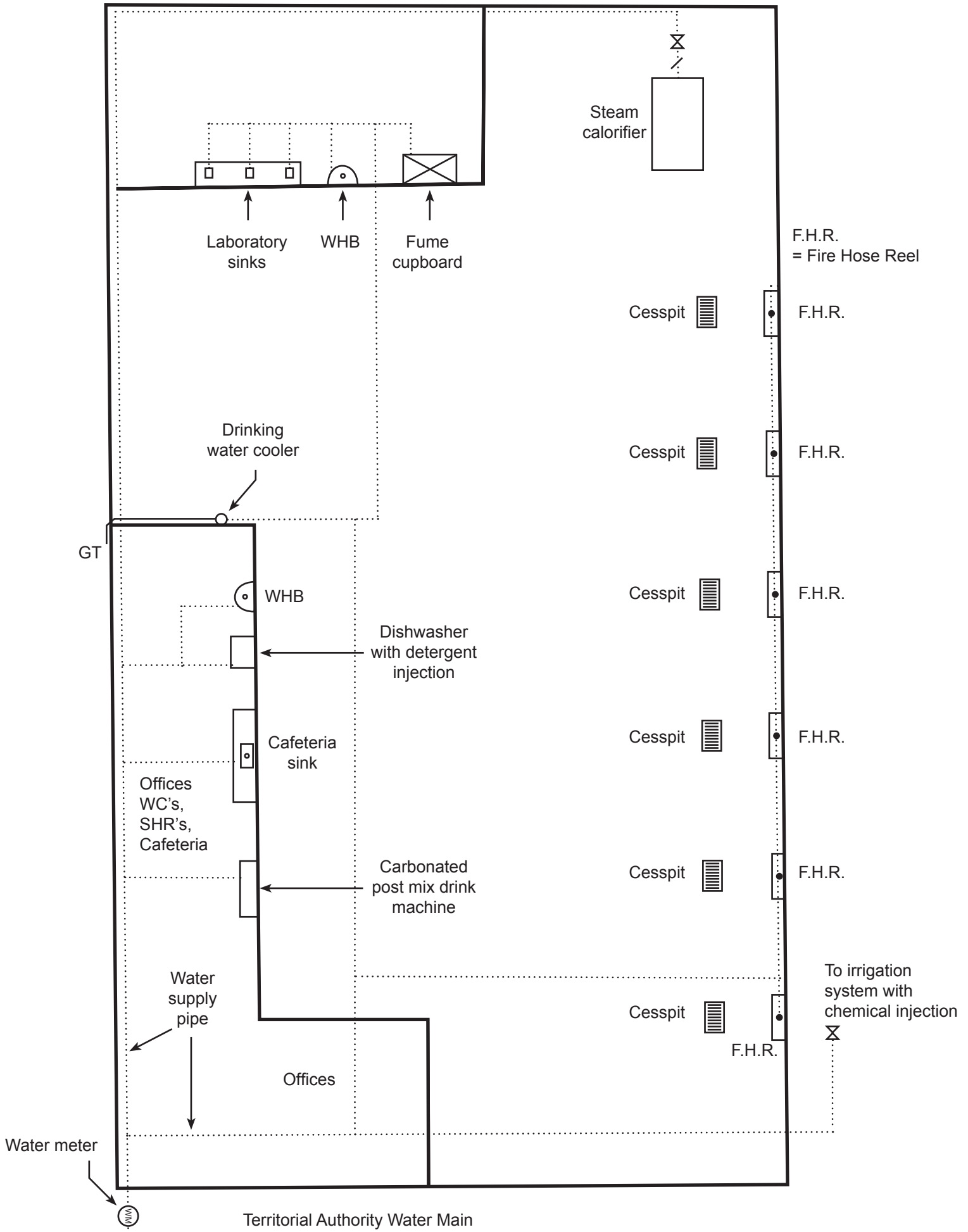
(e) State how often it is necessary to inspect a backflow prevention device, and who is required to arrange for the inspection.

How often: _____

Who: _____

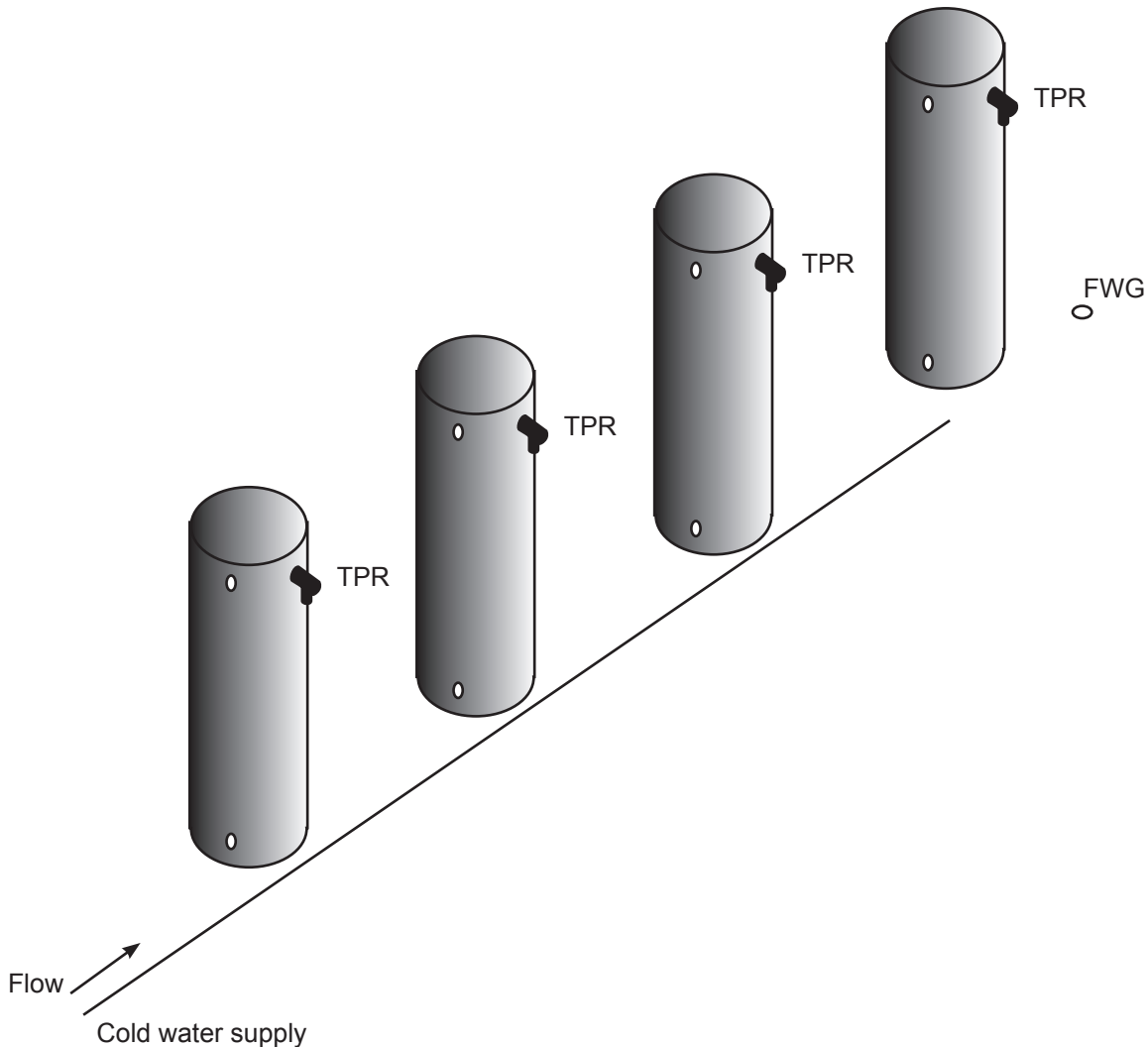
(2 marks)

Total 16 marks



QUESTION 6

The diagram below shows four commercial storage hot water heaters that are to be connected. The hot and cold water supply pipes are to be connected to the water heaters to give an equal (balanced) flow.



- On the diagram and using a ruler, draw a line diagram of the hot and cold water supply pipes connected to the water heaters to give an equal (balanced) flow. Your answer is to include isolation valves that would allow the isolation of an individual cylinder.
- There is a common drain line receiving discharge from the temperature and pressure relief valves and the cylinder drain valves. This common drain line terminates at the floor waste gully.

On the diagram and using a ruler, neatly draw the pipework that is required. Show only isolating valves and drain valves. Do not include cold water expansion valves or hot water tempering valves.

Total 12 marks

QUESTION 7

- (a) A hot water cylinder has an open vent. The location is prone to freezing.

State the height above the water level that the vent pipe must be insulated.

(1 mark)

- (b) An open vent from a storage hot water cylinder is blocked and the cylinder thermostat fails to turn off the element.

State the sequence of events that are likely to occur.

(3 marks)

- (c) Explain how a calorifier heats water.

(2 marks)

Total 6 marks

QUESTION 8

- (a) A cylindrical storage water heater with a capacity of 450 litres has a 7.2kW heating element.

Calculate how long it takes to heat the contents from 8°C to 75°C, given that the thermal efficiency of the heating unit is 95%. Show all working.

The specific heat of water is 4.2kJ/kg.

Formula: $\text{Time} = \frac{\text{heat energy required to heat water}}{\text{heat energy consumed by water per hour}}$

$$= \frac{\text{mass of water} \times 4.2 \times (T_2 - T_1)}{\text{heat energy input per hour} \times \text{efficiency}}$$

(3 marks)

QUESTION 8 (cont'd)

- (b) Calculate the number of litres of hot water at 65°C required to produce 820 litres of warm water at 55°C when mixed with cold water at 12°C.

Formula:

$$\text{Litres of hot water required} = \frac{\text{Litres of warm water required} \times \text{Temperature rise from cold to mixed}}{\text{Temperature rise from cold to hot}}$$

(2 marks)

- (c) Calculate the heat input, expressed as kWh, required to heat 360 litres of water from 7°C to 73°C.

The specific heat of water is 4.2J/kg.

$$3.6\text{MJ} = 1 \text{ kWh}$$

Formula: Heat input = Temperature difference x mass x specific heat

(2 marks)

Total 7 marks

QUESTION 9

The diagram opposite shows the floor plan of a building with a concrete floor, the sanitary fittings inside the building envelope and the foul water drainage system external to the building.

- (a) Using your knowledge of AS/NZS3500 Part 2: Sanitary plumbing and drainage, design and draw on the diagram the below slab foul water plumbing and drainage system. Include the position of any ventilation pipe(s) required.

(9 marks)

- (b) On your diagram mark the minimum size of each pipe. You may refer to the tables below.

FIXTURE UNIT RATINGS

Fixture	Fixture unit rating	Minimum fixture discharge pipe size
Basin	1	40
Shower	2	40
Sink	3	50
Water closet pan	4	100
Bathroom group	6	–
Laundry tub	5	40
Hand washing trough 1800 long	3	40
Clothes washing machine	5	40

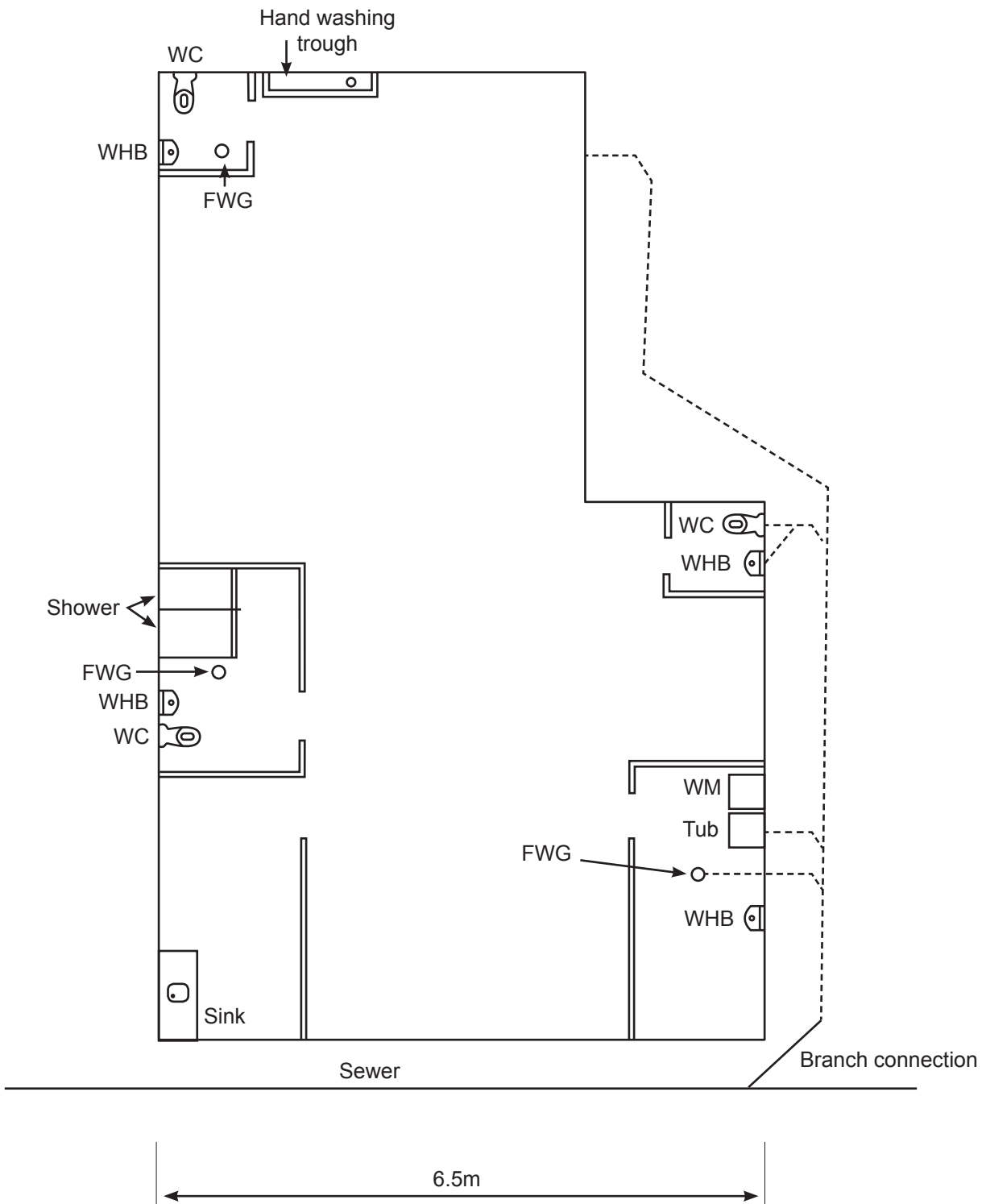
SIZE OF UNVENTED BRANCH DRAINS

Size of pipe DN	Maximum fixture unit loading
65	5 fixture units
80	12 fixture units (including not more than one water closet pan)
100	30 fixture units (including not more than two water closet pans)

(6 marks)

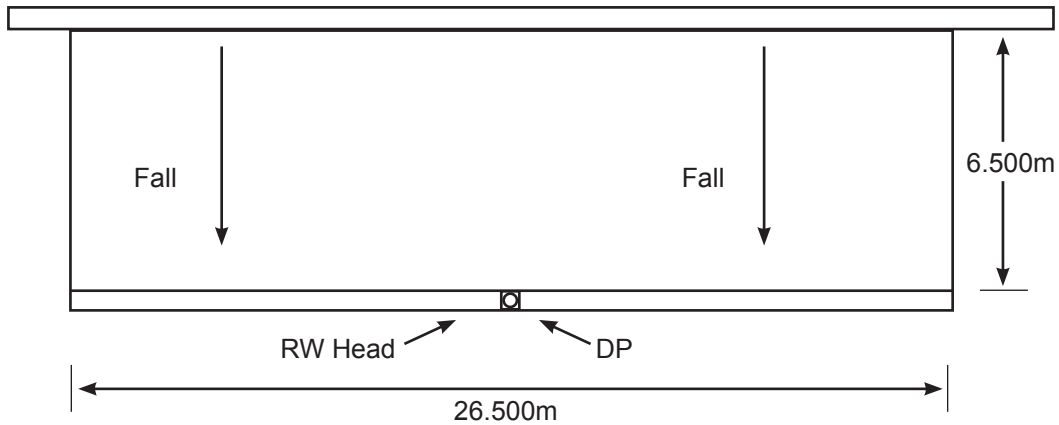
Total 15 marks

QUESTION 9 (cont'd)



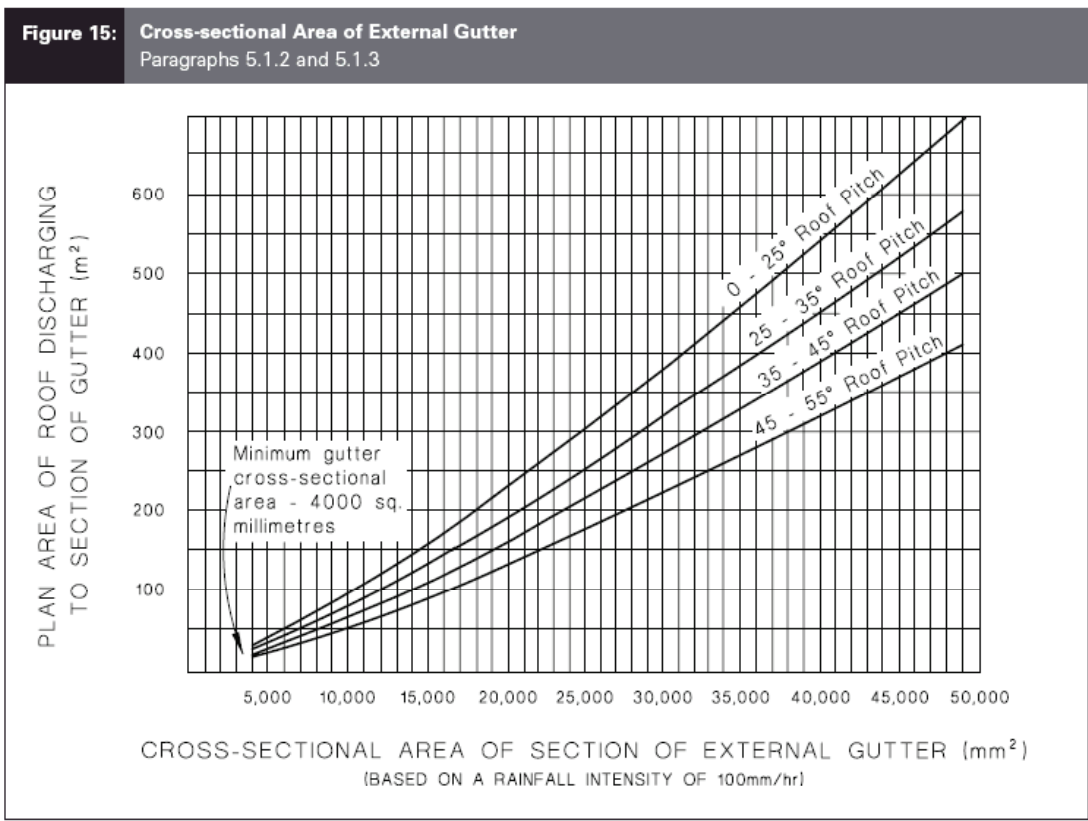
QUESTION 10

The following drawing shows a plan view of a lean-to roof with a pitch of 22.5 degrees.



- (a) Calculate the volume of water which could be collected off the roof in 4 hours if the rainfall intensity is 12mm per hour. Show all workings.

(2 marks)



QUESTION 10 (cont'd)

(b) Using Figure 15, find the cross sectional area of the external gutter required, based on a rainfall intensity of 100mm per hour.

(2 marks)

(c) Using Table 5 find the size of the circular down pipe required.

(1 mark)

Table 5		Downpipe Sizes for Given Roof Pitch and Area Paragraph 4.2.1			
Downpipe size (mm) (minimum internal sizes)	Roof pitch				
	0-25°	25-35°	35-45°	45-55°	
Plan area of roof served by downpipe (m²)					
63mm	60	50	40	35	
74mm diameter	85	70	60	50	
100mm diameter	155	130	110	90	
150mm diameter	350	290	250	200	
65 x 50 rectangular	60	50	40	35	
100 x 50 rectangular	100	80	70	60	
75 x 75 rectangular	110	90	80	65	
100 x 75 rectangular	150	120	105	90	

Total 5 marks

QUESTION 11

Give THREE advantages that a single stack modified system has over a single stack system.

- 1 _____

- 2 _____

- 3 _____

Total 3 marks

For Candidate's use

Number of EXTRA sheets used (write NIL if none have been used).	
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For Examiner's use only

Questions Answered	Marks	Marks
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
Total		