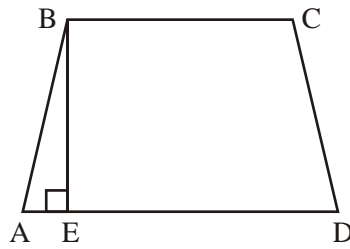


1. ABCD is a trapezium with $AB = CD$ and $[BC]$ parallel to $[AD]$. $AD = 22$ cm, $BC = 12$ cm, $AB = 13$ cm.

Diagram not to scale



- (a) Show that $AE = 5$ cm. (2)
- (b) Calculate the height BE of the trapezium. (2)
- (c) Calculate
- (i) \hat{BAE} ;
- (ii) \hat{BCD} . (3)
- (d) Calculate the length of the diagonal $[CA]$. (3)

(Total 10 marks)

2. The diagram below shows an equilateral triangle ABC, with each side 3 cm long. The side [BC] is extended to D so that CD = 4 cm.

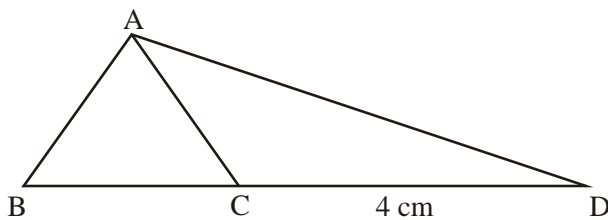


Diagram not to scale

Calculate, **correct to two decimal places**, the length of [AD].

(Total 4 marks)

3. You may choose from three courses on a lunchtime menu at a restaurant.

s: you choose a salad,
m: you choose a meat dish (main course),
d: you choose a dessert.

You choose a **two** course meal which **must** include a main course and either a salad or a dessert, but not both.

- (a) Write the sentence above using logic symbols.

(2)

- (b) Write in words $s \Rightarrow \neg d$.

(2)

- (c) Complete the following truth table.

(2)

<i>s</i>	<i>d</i>	$\neg s$	$\neg s \Rightarrow d$
T	T		
T	F		
F	T		
F	F		

(Total 6 marks)

4. (a) Solve $2x + 3 = 5$.
- (b) Consider the logic statements.

$$p: 2x + 3 = 5 \quad q: x^2 = x$$

The compound proposition $2x + 3 = 5 \Rightarrow x^2 = x$ is given.
Is this compound proposition true?

- (c) Write down the converse of this compound proposition.
- (d) Give an example to show that the converse is false.

(Total 8 marks)

5. Consider the statement "*If a figure is a square, then it is a rhombus*".

- (a) For this statement, write in words

- (i) its converse;
- (ii) its inverse;
- (iii) its contrapositive.

- (b) Only one of the statements in part(a) is true. Which one is it?

(Total 8 marks)

6. Consider the following statements.

p: students work hard
q: students will succeed

- (a) Write the following proposition in symbols using p , q and logical connectives only.

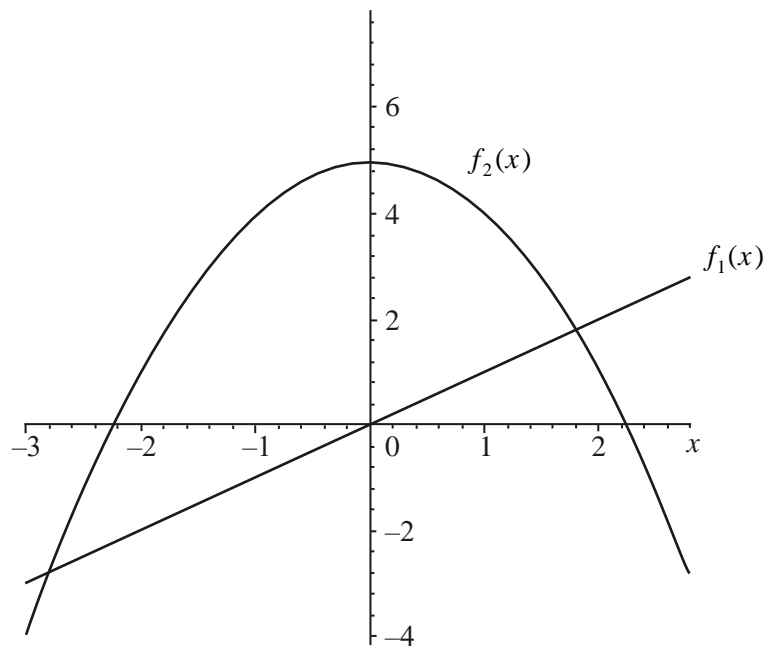
If students do not work hard, then they will not succeed.

- (b) Complete the following truth table, relating to the statement made in part (a), and decide whether the statement is logically valid.

p	q			
T	T			
T	F			
F	T			
F	F			

(Total 8 marks)

7. The figure below shows the graphs of functions $f_1(x) = x$ and $f_2(x) = 5 - x^2$.



- (a) (i) Differentiate $f_1(x)$ with respect to x .
(ii) Differentiate $f_2(x)$ with respect to x .
- (b) Calculate the value of x for which the gradient of the two graphs is the same.
- (c) Draw the tangent to the **curved** graph for this value of x on the figure, showing clearly the property in part (b).

(Total 6 marks)

8. The function $g(x)$ is defined by $g(x) = \frac{1}{8}x^4 + \frac{9}{4}x^2 - 5x + 7, x \geq 0$.

- (a) Find $g(2)$. (2)
- (b) Calculate $g'(x)$. (3)

The graph of the function $y = g(x)$ has a tangent T_1 at the point where $x = 2$.

- (c) (i) Show that the gradient of T_1 is 8.
- (ii) Find the equation of T_1 . Write the equation in the form $y = mx + c$. (5)
- (d) The graph has another tangent T_2 at the point $\left(1, \frac{35}{8}\right)$. T_2 has zero gradient.

Write down the equation of T_2 . (2)

- (e) (i) Sketch the graph of $y = g(x)$ in the region $0 \leq x \leq 3$, $0 \leq y \leq 22$.
- (ii) Add the two tangents T_1 and T_2 to your sketch, in the correct positions. (5)
- (Total 17 marks)**