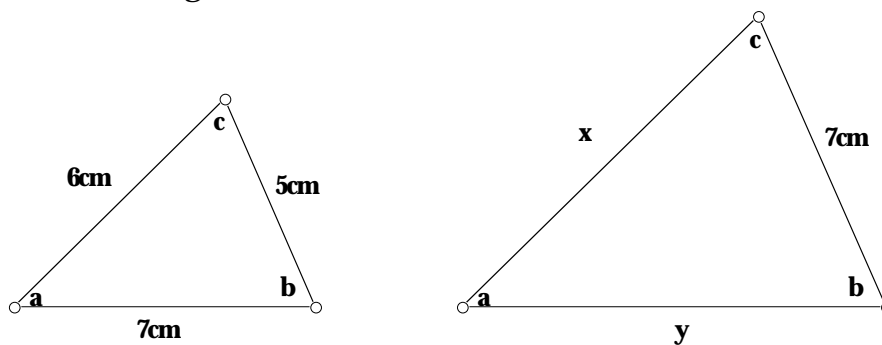


FEBRUARY 1999

INSTRUCTIONS: Unless otherwise stated, give all answers exact or to three significant figures. If a particular method is asked for in a question, credit will be awarded only if the method is employed.

Show all working out. When using the *graphics calculator*, document your work following the directives given in class. Highlight your answers clearly.

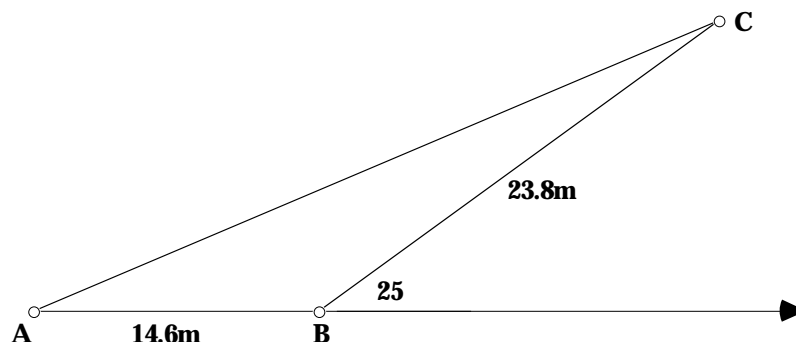
1. The two triangles shown are not drawn to scale.



- (a) State the geometrical relationship between the two triangles in the form "they are _____ triangles".
 (b) Calculate x and y .
 (c) Given that the area of the **bigger** triangle is 28.8 cm^2 (correct to three significant figures), calculate the area of the **smaller** triangle.

(5 marks)

- 2.



Using the above diagram, calculate:

- (i) the length of side AC
 (ii) the measure of $\angle CAB$

(5 marks)

3. (a) Find the range of the function $f: x \rightarrow x^2 - 4$ for the domain D , where $D = \{-4, -3, -2, -1, 0, 1, 2, 3, 4\}$.
- (b) The function $g: x \rightarrow \frac{1}{x-1}$ is not defined over the entire domain D above. Write down the largest subset of D for which function g is defined, and hence find the range of g . (4 marks)

4. The functions f , g and h are defined by
 $f: x \rightarrow x - 2$, $g: x \rightarrow \frac{1}{3}x$, $h: x \rightarrow x^2$

find :

(i) (a) $h(-3)$ (b) $fg(3)$

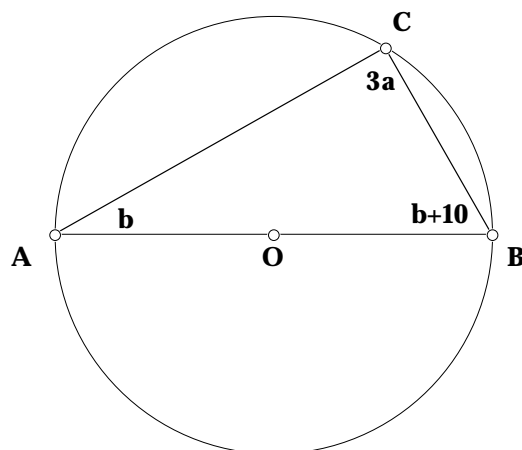
(ii) (a) $f^{-1}(x)$ (b) $g^{-1}(x)$

(iii) Solve (a) $g^{-1}(x) = 0.3$ (b) $f^{-1}g^{-1}(x) = 1$

(iv) Find $hf(x)$ and show that $hf(x) - 2g(x) = 0$ can be written in the form $3x^2 - 14x + 12 = 0$. Hence, solve this equation, giving the answer correct to 2 d.p. (13 marks)

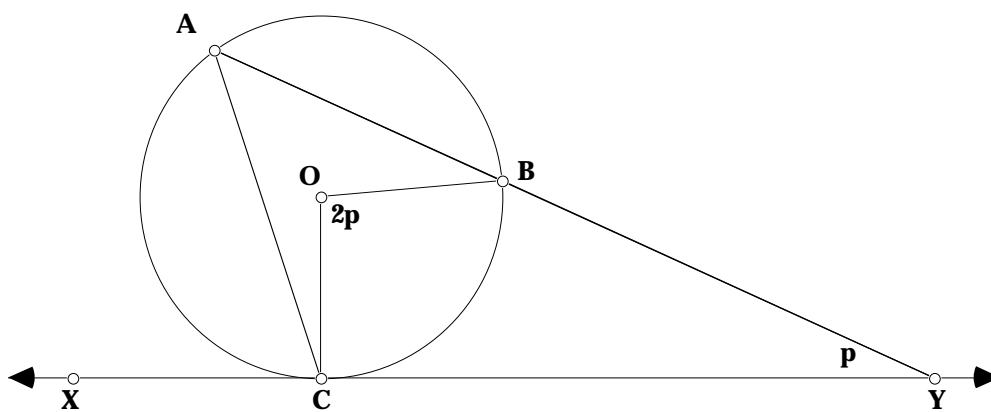
5. (a) $8.5 + 12 + 15.5 + 19 + \dots + 103$ is an arithmetic series. Find n , the number of terms in this series, and hence find the sum of the series.
- (b) In a geometric series, the 7th term is 8 and the 9th term is 18. Find the possible values of the common ratio.
- (c) A man's salary is 800 in his first year in a new job. Each year his salary increases by the same amount over what it was in the previous year. In the ninth year his salary is 1056. Find:
- (i) his salary in the fourteenth year
- (ii) in which year his salary first rises over 1500. (10 marks)

6.



AOB is the diameter of a circle with centre O and C is a point on its circumference. Calculate the values of a and b , giving reasons for your answers. (4 marks)

7. XY is a tangent to the circle with centre O



Find, in terms of p , giving reasons for your answers:

- (i) $\angle BAC$
- (ii) $\angle XCA$
- (iii) $\angle ACO$

(7 marks)

8. Differentiate the following with respect to x :

(i) $x^3 - 4x + \frac{2}{x^2}$

(ii) $5\sqrt{x} - 4$

(iii) $(3x^2 - 2x)^5$

(iv) $\frac{x^2 + 1}{3x - 1}$

(v) $(2x + 3)^2(4 - x)^5$

(13 marks)

9. Find the equation of the gradient of the curve $y = 3x^2 - 2x - 5$ at the point (2, 3).

(5 marks)

10. Find the co-ordinates of any stationary points of

$$y = 5x^6 - 12x^5$$

and distinguish between them.

(5 marks)

11. A ball is thrown vertically downwards at 2 m/s from the top of a high building. Given that the distance, s metres, travelled by the ball in the first t seconds after being thrown is $s = 2t + 5t^2$

(a) Calculate:

- (i) the distance, in metres, traveled by the ball in the first three seconds
- (ii) the distance, in metres, travelled by the ball in the third second
- (iii) the time, in seconds, taken to travel the first 7 metres.

(b)

- (i) Find an expression, in terms of t for the speed, in m/s, at which the ball is travelling t seconds after being thrown.
- (ii) Calculate the speed, in m/s, of the ball 2.25 seconds after being thrown.
- (iii) Find the time, in seconds, taken to reach a speed 17 m/s.
- (iv) Find the acceleration, in m/s^2 , of the ball after t seconds.

(10 marks)