

8 The first term of a progression is $\sin^2 \theta$, where $0 < \theta < \frac{1}{2}\pi$. The second term of the progression is $\sin^2 \theta \cos^2 \theta$.

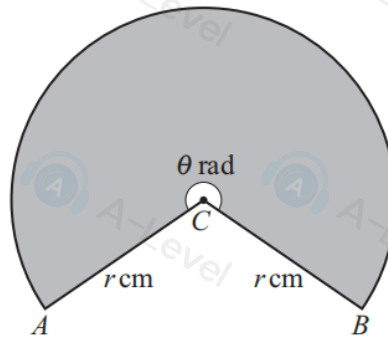
(a) Given that the progression is geometric, find the sum to infinity. [3]

It is now given instead that the progression is arithmetic.

(b) (i) Find the common difference of the progression in terms of $\sin \theta$. [3]

(ii) Find the sum of the first 16 terms when $\theta = \frac{1}{3}\pi$. [3]

3



The diagram shows a sector of a circle with centre C . The radii CA and CB each have length r cm and the size of the reflex angle ACB is θ radians. The sector, shaded in the diagram, has a perimeter of 65 cm and an area of 225 cm².

(a) Find the values of r and θ . [4]

(b) Find the area of triangle ACB . [2]

8. The curve C_1 has equation

$$y = 3x^2 + 6x + 9$$

(a) Write $3x^2 + 6x + 9$ in the form

$$a(x + b)^2 + c$$

where a , b and c are constants to be found.

(3)

The point P is the minimum point of C_1

(b) Deduce the coordinates of P .

(1)

A different curve C_2 has equation

$$y = Ax^3 + Bx^2 + Cx + D$$

where A , B , C and D are constants.

Given that C_2

- passes through P
- intersects the x -axis at -4 , -2 and 3

(c) find, making your method clear, the values of A , B , C and D .

(5)

(b) Find an expression for $(fg)^{-1}(x)$.

[3]

5 Solve the equation

$$4 \sin \theta \tan \theta = 1 + 5 \cos \theta$$

for $-180^\circ < \theta < 180^\circ$.

[6]

5.

Diagram **NOT**
accurately drawn

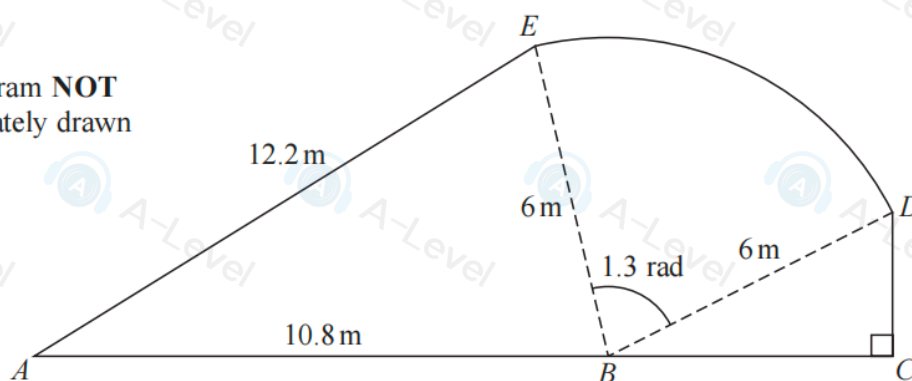


Figure 2

Figure 2 shows the plan view of a garden.

The shape of the garden $ABCDEA$ consists of a triangle ABE and a right-angled triangle BCD joined to a sector BDE of a circle with radius 6 m and centre B .

The points A , B and C lie on a straight line with $AB = 10.8$ m

Angle $BCD = \frac{\pi}{2}$ radians, angle $EBD = 1.3$ radians and $AE = 12.2$ m

- (a) Find the area of the sector BDE , giving your answer in m^2 (2)
- (b) Find the size of angle ABE , giving your answer in radians to 2 decimal places. (2)
- (c) Find the area of the garden, giving your answer in m^2 to 3 significant figures. (3)

(b) Determine the nature of the stationary point. [2]

(c) For positive values of x , determine whether the curve shows a function that is increasing, decreasing or neither. Give a reason for your answer. [2]

5 In the expansion of $(a + bx)^7$, where a and b are non-zero constants, the coefficients of x , x^2 and x^4 are the first, second and third terms respectively of a geometric progression.

Find the value of $\frac{a}{b}$. [5]

8.

In this question you must show all stages of your working.

Solutions relying entirely on calculator technology are not acceptable.

(a) Find the equation of the tangent to the curve with equation

$$y = \frac{1}{4}x^3 - 8x^{\frac{1}{2}}$$

at the point $P(4, 12)$

Give your answer in the form $ax + by + c = 0$ where a , b and c are integers.

(5)

The curve with equation $y = f(x)$ also passes through the point $P(4, 12)$

Given that

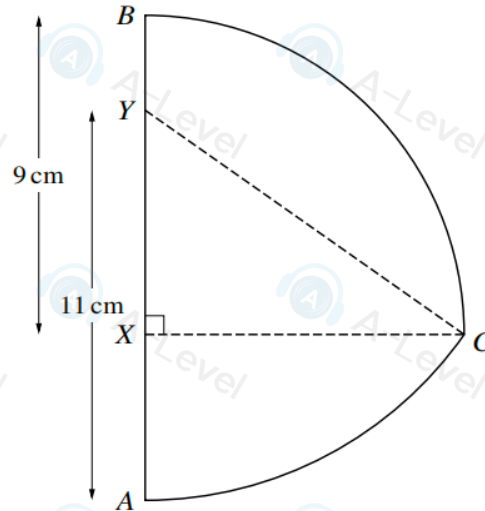
$$f'(x) = \frac{1}{4}x^3 - 8x^{\frac{1}{2}}$$

(b) find $f(x)$ giving the coefficients in simplest form.

(5)

DO NOT

5



In the diagram, X and Y are points on the line AB such that $BX = 9$ cm and $AY = 11$ cm. Arc BC is part of a circle with centre X and radius 9 cm, where CX is perpendicular to AB . Arc AC is part of a circle with centre Y and radius 11 cm.

(a) Show that angle $XYC = 0.9582$ radians, correct to 4 significant figures.

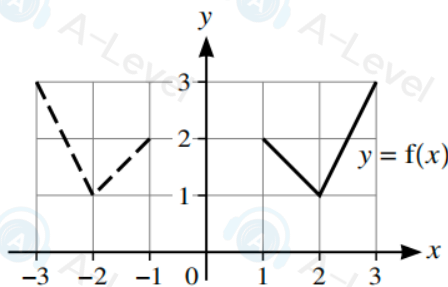
[1]

(b) Find the perimeter of ABC .

[6]

3 In each of parts (a), (b) and (c), the graph shown with solid lines has equation $y = f(x)$. The graph shown with broken lines is a transformation of $y = f(x)$.

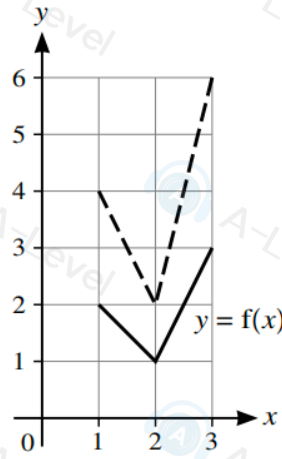
(a)



State, in terms of f , the equation of the graph shown with broken lines.

[1]

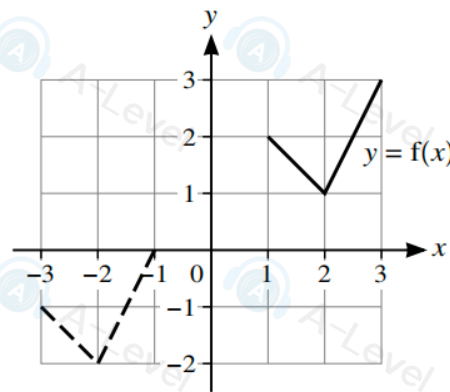
(b)



State, in terms of f , the equation of the graph shown with broken lines.

[1]

(c)



State, in terms of f , the equation of the graph shown with broken lines.

[2]