

7.1 Revision

*Any solution based entirely on graphical
or numerical methods is not acceptable*

Marks Available : 40

Question 1

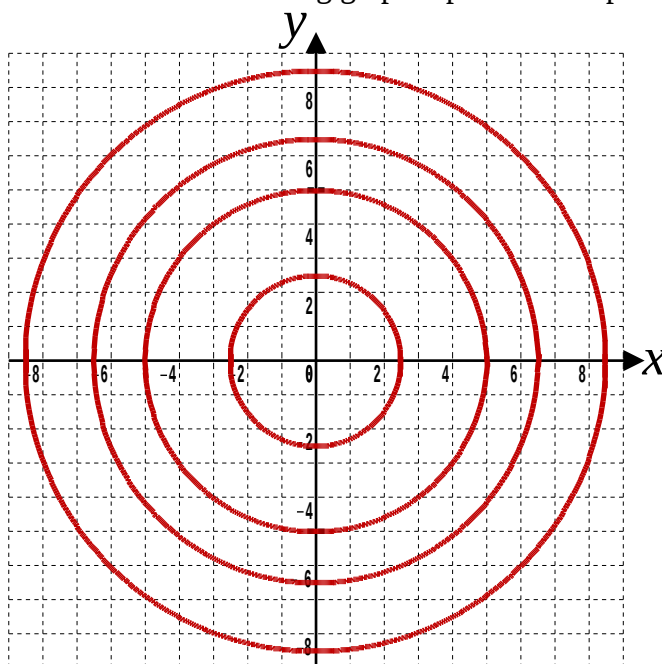
- (i) Determine the general solution to the differential equation, $\frac{dy}{dx} = -\frac{x}{y}$

[3 marks]

- (ii) The general solution is represented by all possible circles centred on the origin. Given that $y = 6$ when $x = 2.5$ find the particular solution. Present your solution in the form $x^2 + y^2 = r^2$ where r is a constant.

[1 mark]

- (iii) Which circle on the following graph represents the particular solution ?



[1 mark]

Question 2

A-Level Examination Question from June 2012, Paper C4, Q4 (Edexcel)

Given that $y = 2$ at $x = \frac{\pi}{4}$, solve the differential equation,

$$\frac{dy}{dx} = \frac{3}{y \cos^2 x}$$

[5 marks]

Question 3

A-Level Examination Question from October 2020, Paper 1, Q14 (Edexcel)

A large spherical balloon is deflating.

At time t seconds the balloon has radius r cm and volume V cm³

The volume of the balloon is modelled as decreasing at a constant rate.

(a) Using this model, show that $\frac{dr}{dt} = -\frac{k}{r^2}$ where k is a positive constant.

[3 marks]

Given that

- the initial radius of the balloon is 40 cm
- after 5 seconds the radius of the balloon is 20 cm
- the volume of the balloon continues to decrease at a constant rate until the balloon is empty

(b) solve the differential equation to find a complete equation linking r and t

[5 marks]

(c) Find the limitation on the values of t for which the equation in part (b) is valid.

[2 marks]

Question 4

A-Level Examination Question from June 2011, Paper C4, Q8 (Edexcel)

(a) Find $\int (4y + 3)^{-\frac{1}{2}} dy$

[2 marks]

(b) Given that $y = 1.5$ at $x = -2$, solve the differential equation,

$$\frac{dy}{dx} = \frac{\sqrt{(4y + 3)}}{x^2}$$

giving your answer in the form $y = f(x)$

[6 marks]

Question 5

A-Level Examination Question from January 2011, Paper C4, Q3 (Edexcel)

(a) Express in partial fractions;

$$\frac{5}{(x - 1)(3x + 2)}$$

[3 marks]

(b) Hence find;

$$\int \frac{5}{(x - 1)(3x + 2)} dx, \quad x > 1$$

[3 marks]

(c) Find the particular solution of the differential equation

$$(x - 1)(3x + 2) \frac{dy}{dx} = 5y, \quad x > 1$$

for which $y = 8$ at $x = 2$

Give your answer in the form $y = f(x)$

[6 marks]

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Teachers may obtain detailed worked solutions to the exercises by email from MHHShrewsbury@Gmail.com