Year 1 Pure Mathematics Examination Revision
Health Check N° 1

Statistically, nine out of ten injections are in vein.

Questions kindly provided by Jeremy Lucas

Any solution based entirely on graphical
or numerical methods is not acceptable
Marks Available : 70

Question 1

(i) Complete the square for $x^2 - 8x - 13$

[2 marks]

(ii) Hence state the minimum value of the function,

$$f(x) = x^2 - 8x - 13, \qquad x \in \mathbb{R}$$

[1 mark]

(iii) Also state the value of x for which the minimum value occurs.

[1 mark]

Question 2

(i) Expand $(1 - 2x)^8$ in ascending powers of x up to and including the term in x^3. Simplify each term where it's appropriate to do so.

[3 marks]

(ii) Hence find an approximation to the value of 0.98^8 to four decimal places.

[2 marks]

Question 3

(i) Solve the equation $\sin 2x = 0.5$ for $0 \leqslant x \leqslant 360°$

[4 marks]

(ii) Solve the equation $\sin^2 x = \cos x - 1$ for $-360 \leqslant x \leqslant 360$

[4 marks]

Question 4

(i) Differentiate $y = \dfrac{x^2 + 2x + 3}{x}$

[4 marks]

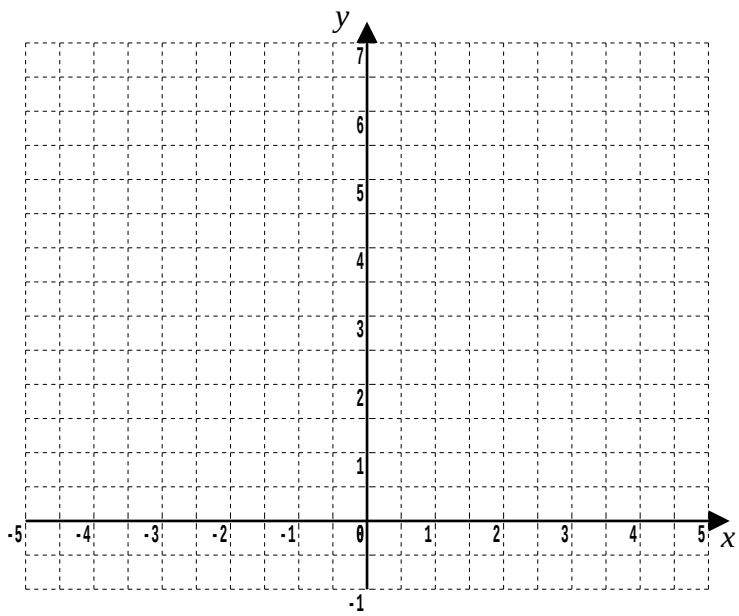
(ii) Integrate $\int \dfrac{4x - 9}{\sqrt{x}}\, dx$

[4 marks]

Question 5

On the graph paper sketch **(i)** $y = (x - 2)^2$

(ii) $y = (x + 4)(x + 1)^2$



[5 marks]

Question 6

A triangle has sides of length 4 cm, 5 cm and 6 cm.

(i) Find the size of the smallest angle in the triangle.
Give your answer correct to 3 significant figures.

[3 marks]

(ii) Find the area of the triangle.
Give your answer correct to 3 significant figures.

[3 marks]

Question 7

Solve the simultaneous equations; $x^2 + y^2 = 100$

$x - y = 2$

[4 marks]

Question 8

Solve the inequalities

(i) $4x^2 + 3 < 39$

[3 marks]

(ii) $x^2 + 5x > 14$

[3 marks]

Question 9

A circle has equation $x^2 + y^2 - 6x + 4y - 3 = 0$

(i) Find the centre and radius of the circle

[3 marks]

(ii) Find the equation of the tangent to the circle at (3, 2)

[4 marks]

Question 10

A straight line L_1 is given by the equation $2x + 3y = 13$

(i) Find the equation of the line L_2 which is parallel to L_1 and passes through the point $(1, 5)$

[2 marks]

(ii) Find the equation of the line L_3 which is perpendicular to L_1 and passes through the point $(1, 5)$

[2 marks]

Question 11

A curve is given by the equation $y = x^3 - 3x^2 - 9x + 15$

(i) Find the coordinates of the two turning points

[4 marks]

(ii) Classify each of these turning points as a minimum or a maximum

[2 marks]

Question 12

Solve the following equations,

(i) $2^{2x} - 3 \times 2^{x} + 2 = 0$

[3 marks]

(ii) $2\,log_3(x + 2) - log_3 x = 2$

[3 marks]