Grade Grabber 11

40 Mark Paper

Question 1

Photograph by Martin Hansen

The time taken, *T* seconds, to boil one litre of water (at room temperature) is inversely proportional to the power, *P* watts, of the kettle.

When a kettle rated with *P* = 2 kilowatts, the time take, *T* = 72 seconds

Find the time it will take to boil one litre of water (at room temperature) when a kettle rated with *P* = 0.8 kilowatts is used.

[4 marks]

Question 2

By using the theorem of Pythagoras, or otherwise, find the distance between the points (3, 1) and (23, 16)

[3 marks]

Question 3

Writing answers in standard form and correct to three significant figures, calculate;

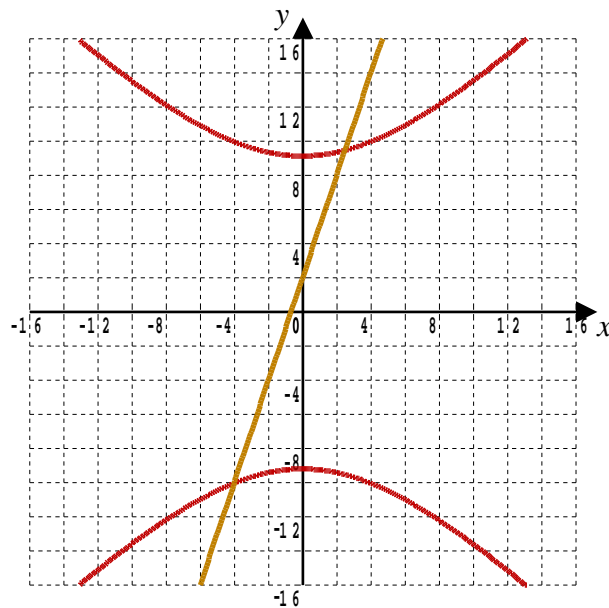(**i**) $4.683 \times 10^6 + 8.908 \times 10^5$

[**1 mark**]

(**ii**) $5.2281 \times 10^{-4} \times 3.735 \times 10^{-2}$

[**1 mark**]

(**iii**) π^{20}

[**1 mark**]

Question 4

The graph shows a hyperbola (in red) and a straight line (in gold)

The hyperbola has equation $y^2 - x^2 = 84$ and the line has equation $y = 3x + 2$

Use algebra to determine the two points at where the hyperbola and line intersect.

[**5 marks**]

Question 5

Expand the brackets and simplify; $\left(3 - \sqrt{6} \right)\left(\sqrt{2} + \sqrt{3} \right)$

Show clear algebraic working.

[3 marks]

Question 6

(**i**)   Show that $\dfrac{x^3 - 4}{x^2} = x - 4x^{-2}$

[1 mark]

(**ii**)   Hence, or otherwise, use calculus to find the turning point on the curve;
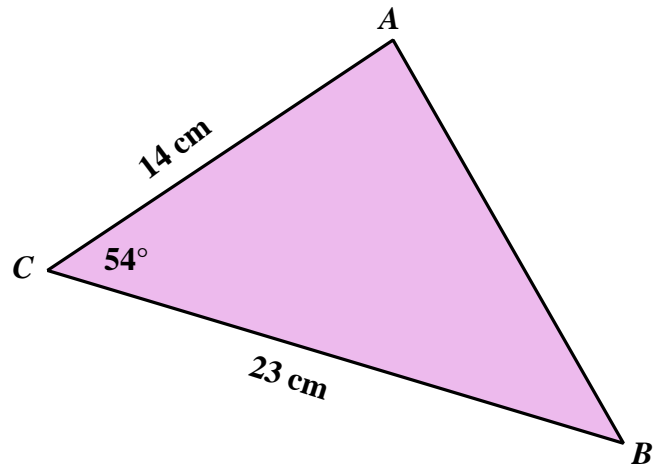
$$y = \dfrac{x^3 - 4}{x^2}$$

[4 marks]

(**iii**)   State, with a reason, if the turning point is a minimum or a maximum

[2 marks]

Question 7

Calculate the length of AB

[3 marks]

Question 8

Solve the following equation giving exact answers,

$$\frac{x}{x-2} + \frac{4}{x+3} = 7$$

[5 marks]

Question 9

(i) Write the recurring decimal   0.272 727 272 727…
as a fraction in the form

$$\frac{p}{q}$$

where p and q are integers with no factor in common.

[3 marks]

(ii) Write the recurring decimal 0.*aba bab aba bab aba …*
as a fraction in the form

$$\frac{p}{q}$$

where p is expressed in terms of a and b
and q is an integer.

[4 marks]