RAFFLES INSTITUTION
RAFFLES PROGRAMME 2024
YEAR 3 MATHEMATICS
MID-YEAR HOLIDAY ASSIGNMENT 1

Total mark: 40 marks **Duration: 1 hour**

Name: ( ) Class: 3( ) Date:

Topic 1: Surds

1 Given that $\left(2-5\sqrt{2}+\frac{4}{3-2\sqrt{2}}\right)\left(3-\sqrt{2}\right)=a+b\sqrt{2}$, find the value of ***a*** and of ***b***. [3]

[Ans: a = 36, b = −5]

2 Solve $\sqrt{3x-3}+\sqrt{2x-4}=\sqrt{6x+1}$. [3]

[Ans: x = 4]

Topic 2: Graphical Solutions of Equations

3 The diagram shows part of the graph of $y=16-\frac{1}{4}x^2-\frac{10}{x}$ for $\frac{1}{2}\le x\le 8$ (on P.2) .

(a) Find, from the graph,

(i) the solutions of the equation $14-\frac{1}{4}x^2-\frac{10}{x}=0$, [2]

(ii) the range of values of x for which $64-x^2-\frac{40}{x}\ge 16-2x$. [3]

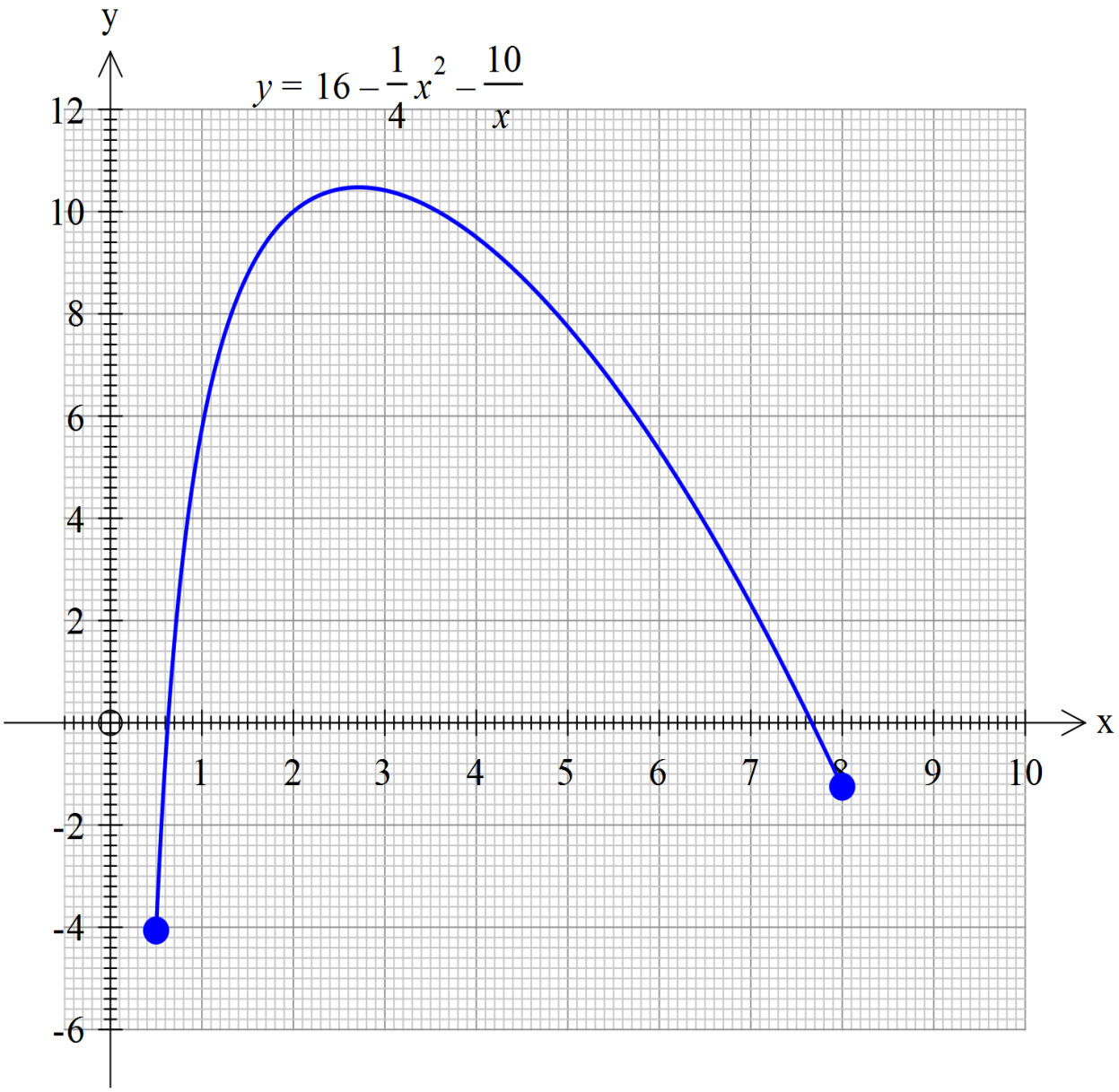
(b) By drawing a tangent, find the gradient of the graph at the point where $x = 5$.

[2]

(c) By adding a suitable straight line to your graph, solve the equation

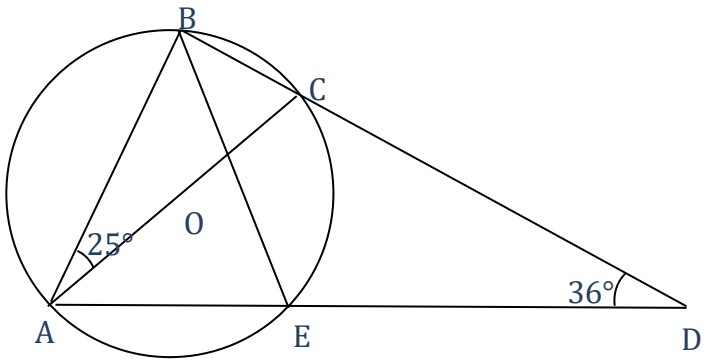
$x^3+8x^2-52x+40=0$. [3]

[Ans: (a)(i) x = 0.7 or 7 (ii) $0.8\le x\le 7.6$ *(b) −2.11 (c) x= 0.9 or 3.5]*



Topic 3: Geometrical Properties of Circles

4



In the diagram, *AC* is a diameter of the circle centre *O*, ∠*ADC* = 36° and ∠*BAC* = 25°. Calculate

(i) ∠*BOC*, (ii) ∠*CAE*, (iii) ∠*EBC*. [3]

[Ans: (i) 50° (ii) 29° (iii) 29°]

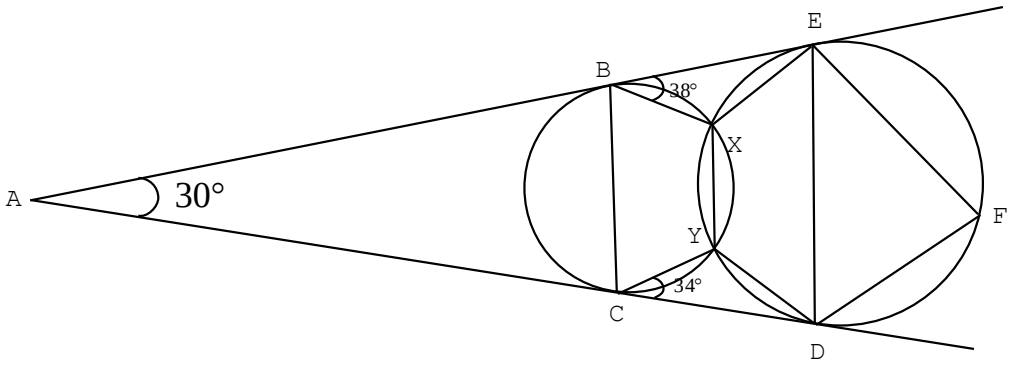
5 In the diagram, *AE* is a tangent to the two circles at *B* and *E*. Similarly, AD is a tangent to the two circles at *C* and *D*. Given that $C\hat{A}B = 30°$, $E\hat{B}X = 38°$, $D\hat{C}Y = 34°$, and *CY* = *DY*. Find the values of

(i) $A\hat{B}C$, [1]

(ii) $C\hat{Y}X$, [1]

(iii) $E\hat{F}D$, [1]

(iv) $E\hat{F}X$. [2]



[Ans: (i) 75°(ii) 113°(iii) 75° (iv) 30°]

Topic 4: Quadratic Functions

6 (a) By completing the square, find the maximum value of $y = 5 - 4x - x^2$ and state the value of *x* when this occurs. [3]

(b) Sketch the graph of $y = 5 - 4x - x^2$, showing clearly the maximum point and intercepts with the axes. [3]

[Ans: (a) max y = 9 when x = –2]

7 (a) Find the least value of *k* for which $x(x + k) - k$ is never negative for all real values of *x*. [3]

(b) Prove that the line $y = 3x + m$ will meet the curve $y = mx^2 + x + 2$ for all real values of *m*. [3]

[Ans: (a) –4]

Topic 6: Binomial Theorem

8 (i) Write down and simplify, in ascending powers of *x*, the first three terms in the expansion of $\left(2 - \frac{x}{4}\right)^9$. [2]

(ii) Hence, find the coefficient of x^2 in the expansion of $(1 - x)(2 + x)\left(2 - \frac{x}{4}\right)^9$. [2]

[Ans: (i) $512 - 576x + 288x^2$ *(ii) 640]*