19 Solve the simultaneous equations

$$3x^2 + y^2 - xy = 5$$
$$y = 2x - 3$$

Show clear algebraic working.

....

(Total for Question 19 is 5 marks)

20 (a) Express $7 + 12x - 3x^2$ in the form $a + b(x + c)^2$ where a, b and c are integers.

....

(3)

C is the curve with equation $y = 7 + 12x - 3x^2$

The point A is the maximum point on **C**

(b) Use your answer to part (a) to write down the coordinates of A

$(................... , ...)$

(1)

(Total for Question 20 is 4 marks)

21 The diagram shows the prism *ABCDEFGHJK* with horizontal base *AEFG*

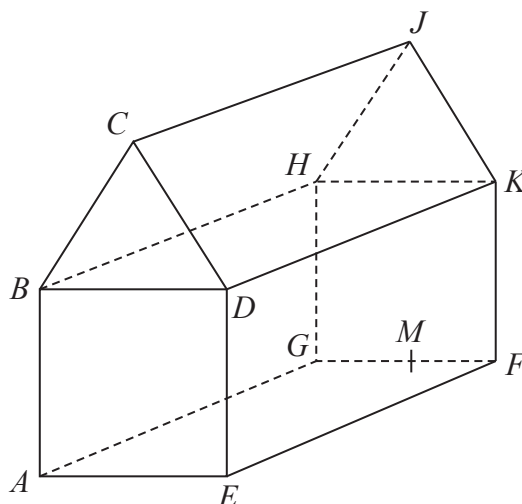Diagram **NOT** accurately drawn

ABCDE is a cross section of the prism where
 ABDE is a square
 BCD is an equilateral triangle

EF = 2 × *AE*
M is the midpoint of *GF* so that *JM* is vertical.

Angle *MAJ* = $y°$

Given that $\tan y° = T$

find the value of *T*, giving your answer in the form $\dfrac{\sqrt{p} + \sqrt{q}}{17}$ where *p* and *q* are integers.

$T =$ ....

(Total for Question 21 is 5 marks)

Turn over for Question 22

Turn over ▶

22 The diagram shows triangle OAB
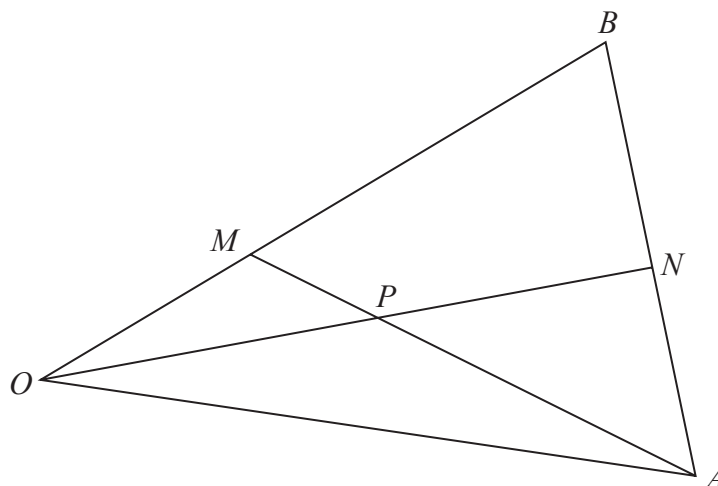
Diagram **NOT** accurately drawn

$\overrightarrow{OA} = 8\mathbf{a}$ $\qquad$ $\overrightarrow{OB} = 6\mathbf{b}$

M is the point on OB such that $OM:MB = 1:2$
N is the midpoint of AB
P is the point of intersection of ON and AM

Using a vector method, find $\overrightarrow{OP}$ as a simplified expression in terms of $\mathbf{a}$ and $\mathbf{b}$
Show your working clearly.

$\overrightarrow{OP} =$ ....

(Total for Question 22 is 5 marks)

Turn over for Question 23

23 The diagram shows a sketch of the curve with equation $y = f(x)$
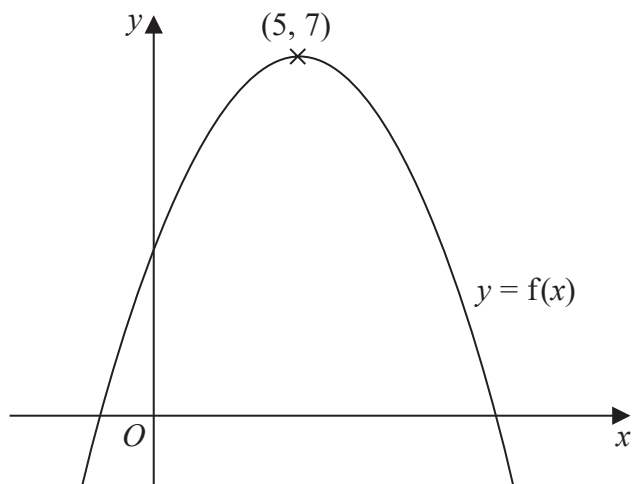
There is only one maximum point on the curve.
The coordinates of this maximum point are (5, 7)

Write down the coordinates of the maximum point on the curve with equation

 (i) $y = f(x + 9)$

(........................ , ...)

(ii) $y = f(x) + 3$

(........................ , ...)

(Total for Question 23 is 2 marks)

24 The curve **C** has equation $y = ax^3 + bx^2 - 12x + 6$ where a and b are constants.

The point A with coordinates $(2, -6)$ lies on **C**
The gradient of the curve at A is 16

Find the y coordinate of the point on the curve whose x coordinate is 3
Show clear algebraic working.

$y = $ ....

(Total for Question 24 is 6 marks)

TOTAL FOR PAPER IS 100 MARKS