8. **In this question you must show all stages of your working.**
Solutions relying entirely on calculator technology are not acceptable.

The parabola C has equation $y^2 = 4ax$, where a is a positive constant.

The point $P(ap^2, 2ap)$ lies on the parabola C.

(a) Use calculus to show that an equation of the tangent to C at P is

$$py = x + ap^2$$

(4)

The tangent to C at the point P intersects the directrix of C at the point B and intersects the x-axis at the point D.

Given that the y-coordinate of B is $\frac{5}{6}a$ and $p > 0$

(b) find, in terms of a, the x-coordinate of D.

(6)

Given that O is the origin,

(c) find, in terms of a, the area of the triangle OPD, giving your answer in its simplest form.

(2)

(Total for Question 8 is 12 marks)

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9. $$\mathbf{A} = \begin{pmatrix} 6 & 4 \\ 1 & 1 \end{pmatrix}$$

(a) Show that $\mathbf{A}$ is non-singular.

(2)

The triangle R is transformed to the triangle S by the matrix $\mathbf{A}$.

Given that the area of the triangle R is 10 square units,

(b) find the area of triangle S.

(2)

Given that

$$\mathbf{B} = \mathbf{A}^4$$

and that the triangle R is transformed to the triangle T by the matrix $\mathbf{B}$,

(c) find, without evaluating $\mathbf{B}$, the area of triangle T.

(2)

(Total for Question 9 is 6 marks)
