8. On the curve $y = x^3$ a tangent is drawn from the point (a, a^3), $a > 0$ and a normal is drawn from the point $(-a, -a^3)$. The tangent and the normal meet on the y-axis. Find the value of a. *[6 marks]*

5. If $\int_3^9 f(x)\mathrm{d}x = 7$, evaluate $\int_3^9 2f(x)+1\,\mathrm{d}x$. *[4 marks]*

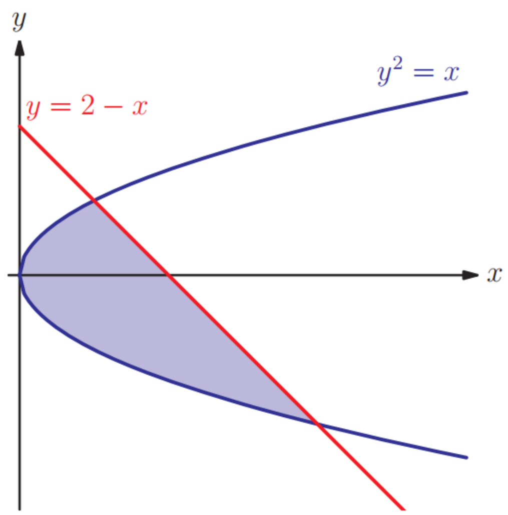
6. Solve the equation $\int_1^a \sqrt{t}\ \mathrm{d}t = 42$. *[5 marks]*

2. Find the area enclosed between the graphs of $y = x^2 + x - 2$ and $y = x + 2$. *[6 marks]*

3. Find $\int \frac{\cos 2x}{\cos x - \sin x}\mathrm{d}x$. *[5 marks]*

4. The gradient of the normal to a curve at any point is equal to the x-coordinate at that point. If the curve passes through the point $(e^2, 3)$ find the equation of the curve in the form $y = \ln(g(x))$ where $g(x)$ is a rational function, $x > 0$. *[6 marks]*

9. Show that the shaded area in the diagram below is $\frac{9}{2}$. *[8 marks]*



7. Find the area enclosed between the graphs of $y = \sin x$ and $y = 1 - \sin x$ for $0 < x < \pi$. *[3 marks]*

8. (a) The function $f(x)$ has a stationary point at $(3,19)$ and $f''(x) = 6x + 6$.

What kind of stationary point is $(3,19)$? *[5 marks]*

(b) Find $f(x)$.

1. (a) Find the coordinates of the points of intersection of the graphs $y = 5a^2 + 4ax - x^2$ and $y = x^2 - a^2$.

(b) Find the area enclosed between these two graphs.

(c) Show that the fraction of this area above the axis is independent of a and state the value that this fraction takes. *[10 marks]*

11. Given that $f(x) = x^2\sqrt{1+x}$, show that $f'(x) = \dfrac{x(a+bx)}{2\sqrt{1+x}}$

where a and b are constants to be found. *[6 marks]*

12. (a) Write $y = x^x$ in the form $y = e^{f(x)}$.

(b) Hence or otherwise find $\dfrac{dy}{dx}$.

(c) Find the exact coordinates of the stationary points of the curve $y = x^x$. *[8 marks]*

6. Show that the graph of $y = \arcsin(x^2)$ has no points of inflexion. *[6 marks]*

9. Find the coordinates of stationary points on the curve with equation $(y-2)^2 e^x = 4x$. *[7 marks]*

4. A curve is given by the implicit equation $x^2 - xy + y^2 = 12$.

(a) Find the coordinates of the stationary points on the curve.

(b) Show that at the stationary points, $(x-2y)\dfrac{d^2y}{dx^2} = 2$.

(c) Hence determine the nature of the stationary points. *[16 marks]*