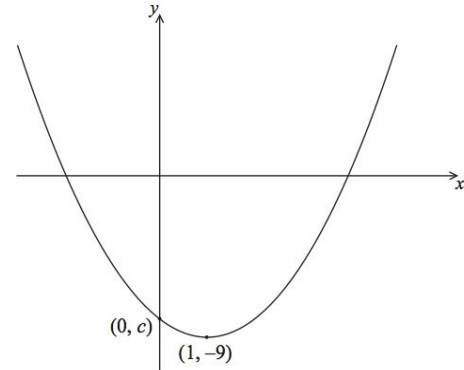


Math SL PROBLEM SET 95

1. **(F2.4) (CI)** The following diagram shows part of the graph of a quadratic function f . The vertex is at $(1, -9)$ and the graph crosses the y -axis at the point $(0, c)$. The function can be written in the form $f(x) = (x - h)^2 + k$.

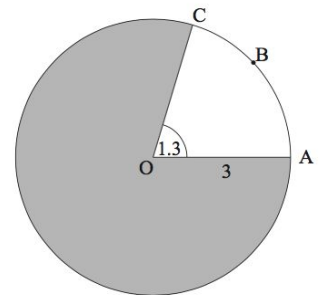


- Write down the value of h and of k .
- Find the value of c .

Let $g(x) = -(x - 3)^2 + 1$. The graph of g is obtained by a reflection of the graph of f around the x -axis, followed by a translation of p units horizontally and q units vertically.

- Find the values of p and q .
- Find the x -coordinates of the points of intersection of the graphs of f and g .

2. **(T3.1) (CA)** The following diagram shows a circle with centre O and radius 3 cm. Points A , B , and C lie on the circle, and $\text{AOC} = 1.3$ radians.



- Find the length of arc ABC .
- Find the area of the shaded region.

3. **(SP5.7) (CA)** The following table shows the probability distribution of a discrete random variable X . Find the value of k and hence, find $E(X)$.

x	0	1	2	3
$P(X=x)$	0.15	k	0.1	$2k$

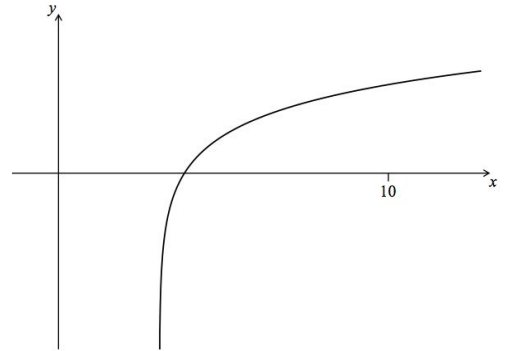
4. **(CA6.3) (CI)** Consider the function $g(x) = x \ln(x^2)$.

- Find $g'(x)$ and $g''(x)$.
- Does the graph of g have an inflexion point. Explain/justify your reasoning.

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5. **(F2.6, C6.5) (CA)** Let $f(x) = 2\ln(x - 3)$, for $x > 3$. The following diagram shows part of the graph of f .

- Find the equation of the vertical asymptote to the graph of f .
- Find the x -intercept of the graph of f .
- The region enclosed by the graph of f , the x -axis and the line $x = 10$ is rotated 360° about the x -axis. Find the volume of the solid formed.



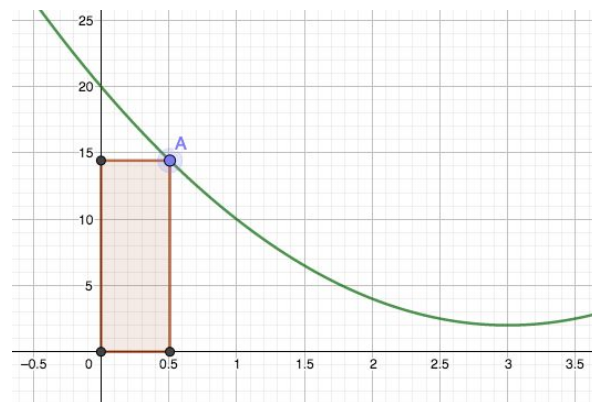
6. **(F2.5, C6.1, C6.5 - R) (CI)** Given the functions $f(x) = \frac{x-3}{x-1}$, $x \neq 1$ and $g(x) = \frac{x+4}{x+2}$, $x \neq -2$;

(Cirrito 5.3.5, p144)

- Rewrite $f(x)$ and $g(x)$ in the form of $y = \frac{a}{x-b} + c$ to help in identifying transformations of the parent function $y = \frac{1}{x}$, $x \neq 0$.
- Sketch each of $f(x)$ and $g(x)$.
- Hence, or otherwise, solve the inequality $f(x) > g(x)$.
- Find the equation of the line that is tangent to $f(x)$ at $x = 5$. What is the significance of the slope of the tangent line?
- Since you have rewritten the equation for $f(x)$, evaluate $\int_4^7 f(x) dx$.

7. **(C6.3 - R) (CA)** The graph shows the parabola $y = 2(x - 3)^2 + 2$ as well as a rectangle drawn from between the x -axis and the curve at Point A; so between the points where $x = 0$ and $x = 0.5$.

- Determine the area of the current rectangle.
- Point A is now free to move along the curve. Determine a value for x such that the area of the rectangle between $x = 0$ and $x = a$ is a maximum area, where $0 < a < 3$.



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8. **(SP5.9) (CA)** The masses of watermelons grown on a farm are normally distributed with a mean of 10 kg. The watermelons are classified as small, medium or large. A watermelon is small if its mass is less than 4 kg. Five percent of the watermelons are classified as small.
- a. Find the standard deviation of the masses of the watermelons.

The following table shows the percentages of small, medium and large watermelons grown on the farm. A watermelon is large if its mass is greater than w kg.

small	medium	large
5%	57%	38%

- b. Find the value of w .

All the medium and large watermelons are delivered to a grocer.

- c. The grocer selects a watermelon at random from **this** delivery. Find the probability that it is medium.
- d. The grocer sells all the medium watermelons for \$1.75 each, and all the large watermelons for \$3.00 each. His costs on this delivery are \$300, and his total profit is \$150. Find the number of watermelons in the delivery.