AP® Calculus AB
2004 Sample Student Responses
Form B

Work for problem 2(a)

$R(t) = 5\sqrt{t}\cos\left(\frac{t}{5}\right)$

$R(6) = 4.438$

the derivative of the function is >0 therefore the function is increasing

Work for problem 2(b)

$R'(x) = \frac{2.5\cos(.2x)}{\sqrt{x}} - \sqrt{x}\sin(.2x)$

$R'(6) = -1.913$

increasing at a decreasing rate because $R'(6) < 0$

Continue problem 2 on page 7.

Work for problem 2(c)

$$1000 + \int_0^{31} 5\sqrt{x}\cos\left(\frac{x}{5}\right)dx = 964$$

Work for problem 2(d)

$x = 7.854$ max - absolute

$x = 23.562$ min

$x = 31$ max

$$1000 + \int_0^{7.854} 5\sqrt{x}\cos\left(\frac{x}{5}\right)dx = \boxed{1039}$$

$$1000 + \int_0^{31} 5\sqrt{x}\cos\left(\frac{x}{5}\right)dx = 964$$

1039 mosquitoes is the maximum number for $0 \le t \le 31$

Work for problem 2(a)

$R(6) = 5\sqrt{6}\cos\left(\frac{6}{5}\right) = 4.438 > 0$

the rate of change in the number of mosquitoes is positive for $t=6$

the number of mosquitoes is increasing

Work for problem 2(b)

$R'(t) = \frac{5\cos\left(\frac{t}{5}\right)}{2\sqrt{t}} - \sqrt{t}\sin\left(\frac{t}{5}\right)$

$R'(6) = -1.913$

the number of mosquitoes in increasing at a decreasing rate at $t=6$ because $R'(6)$ is negative

Continue problem 2 on page 7.

Work for problem 2(c)

$N(t)$ is the number of mosquitoes at time t

$R(t) = N'(t)$

$N(31) - N(0) = \int_0^{31} R(t)$

$N(31) - 1000 = \int_0^{31} 5\sqrt{t}\cos\left(\frac{t}{5}\right) dt$

$N(31) = -35.665 + 1000 \approx 946$ mosquitoes

there will be 946 mosquitoes at $t = 31$

Work for problem 2(d)

maximum number when $R(t) = 0$

$5\sqrt{t}\cos\left(\frac{t}{5}\right) = 0$

$t = 7.853$ $t = 23.561$

at $t = 7.853$ maximum

+++ 0 ---- 0 +++

7.853 23.561

$N(7.853) - N(0) = \int_0^{7.853} R(t)\,dt$

$N(7.853) = 1039.357$

the maximum number of mosquitoes is 1039