Worksheet

① (a) $\sum_{i=1}^{n} 500(12-x_i)^2 \Delta x_i$

(b) $\int_{-3}^{3} 500(12-x^2)\,dx = \boxed{27{,}000 \text{ particles}}$

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② (a) $\sum_{i=1}^{n} (400+100\sin(\pi x_i))\cdot \Delta x_i$

(b) $\int_{0}^{10} (400+100\sin(\pi x))\,dx = \boxed{4000 \text{ cars}}$

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③ (a) $\left(\frac{5000}{1+r}\right)(2\pi r)(\Delta r)$ or $\left(\frac{10{,}000\pi r}{1+r}\right)(\Delta r)$

(b) $\sum_{i=1}^{n} \left(\frac{5000}{1+r_i}\right)(2\pi r_i)(\Delta r_i)$ or $\sum_{i=1}^{n} \left(\frac{10{,}000\pi r_i}{1+r_i}\right)(\Delta r_i)$

(c) $\int_{0}^{10} \frac{10{,}000\pi r}{1+r}\,dr = \boxed{238{,}827 \text{ people}}$

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④ (a) $\sum_{i=1}^{n} (\pi x_i)(20{,}000e^{-.13x_i})(\Delta x_i)$

(b) $\int_{0}^{5} \pi x(20{,}000e^{-.13x})\,dx = \boxed{515{,}387 \text{ people}}$

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⑤ (a) $\sum_{i=1}^{n} (2\pi r_i)\left(\frac{50}{1+r_i}\right)(\Delta r_i)$ or $\sum_{i=1}^{n} \left(\frac{100\pi r_i}{1+r_i}\right)(\Delta r_i)$

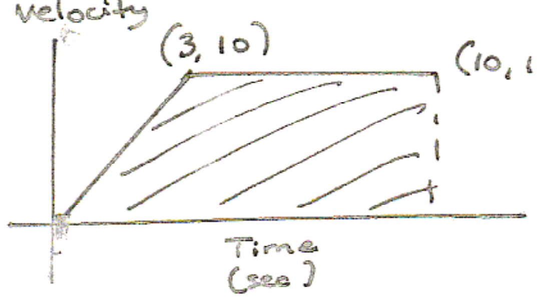
(b) $\int_{0}^{10{,}000} \frac{100\pi r}{1+r}\,dr = \boxed{3{,}138{,}699.108 \text{ kg}}$

(c) $\int_{0}^{a} \frac{100\pi r}{1+r}\,dr = 1{,}569{,}349$

when $\boxed{r = a = 5003.913 \text{ m}}$

Solve(∫(100πr ÷ (1+r), r, 0, a) = 1,569,349, a)

(6)



(a) Distance $= \frac{1}{2}(10)(7+17)$

$= \boxed{85 \text{ m}}$

(b) $v_B(t) = \dfrac{24t}{2t+3}$

Dist. $= \int_0^{10} \dfrac{24t}{2t+3}\,dt = \boxed{83.336}$

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(7) $1000 - \int_0^{60} (5 - 5e^{-0.12t})\,dt = \boxed{741.636 \text{ liters}}$

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(8) (a) Temp. $= 90 - \int_0^{10} 7e^{-0.1t}\,dt = \boxed{45.752° C}$

(b) $\text{Rate}_{AVE} = \frac{1}{10}\int_0^{10} 7e^{-0.1t}\,dt = \boxed{4.425°C/\text{min.}}$

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(9) $P'(t) = 1 - 3e^{-0.2\sqrt{t}}$ gallons per day

(a) $P'(9) = -0.646 < 0$ so the amount is decreasing,

not increasing.

(b) $P'(t) = 0$ at $t = 30.174$ days

Since $P'(t)$ changes from negative to positive at

$t = 30.174$ days, the pollutant is a minimum there

(c) $P(30.174\ldots) = 50 + \int_0^{30.174\ldots} (1 - 3e^{-0.2\sqrt{t}})\,dt$

$= 35.104 < 40$ gallons

so $\boxed{\text{yes,}}$ the lake is safe at $t = 30.174$ days.

(d) $P'(0) = 1 - 3 = -2$

$y = 50 - 2(t - 0)$

or $y = -2t + 50$

$-2t + 50 = 40$

$\boxed{t = 5 \text{ days}}$

(10) (a) $v(t) = e^{2\sin t} - 1 = 0$ when $t = 3.14159\ldots$

$v(t)$ $+$ $-$

$x(t)$ 0   Right   3.14159...   Left   4

The particle is moving right for $0 < t < 3.142$ because $v(t) > 0$ and moving left for $3.142 < t \leq 4$ because $v(t) < 0$.

(b) $x(4) = -1 + \int_0^4 (e^{2\sin t} - 1)\,dt = \boxed{8.671}$

(c) Distance $= \int_0^4 |v(t)|\,dt = \boxed{10.542}$