WORKSHOP 1·9

Part A

Bushfire (Forest Fire)! A bushfire is quickly burning everything in its way. Mathematicians are first on scene and estimate that the fire is spreading in the form of a rectangle. Fire crews respond and arrive after 1 hour. By this point, the mathematicians estimate that the length of the burnt rectangle is 15km and is growing at a rate of 17km/hr, and that the width is 10km and is growing at a rate of 8km/hr. How much area is burnt when they arrive? How quickly is the fire spreading at that point in time?

Part B

Dropping like dropbears! A population of dropbears are caught in the middle of the fire are slowly moving away from the fire. However, they move too slowly and over time, the fire catches up to some of them *sad face*. The number of dropbears that are caught in the fire is dependent on the size of the fire. Latest mathematical reports suggests that the number of dropbears that are being roasted at time t (in hours) is given by $B(t)$, where:

$$B(t) = \frac{A(t)}{F(t)} \qquad\qquad F(t) = 5(t^2 + 1)$$

Find the number of dropbears that have met their fiery end when the fire crews arrive after 1 hour. How quickly are they dying (dropping) after at that point in time? (From the previous problem we know that $A(1) = 150$ km^2 and $A'(1) = 290$ km^2/hr)

Dropbears are native to Australia. According to Wiki: *Drop bears are commonly said to be unusually large, vicious, carnivorous marsupials related to koalas (although the koala is not a bear) that inhabit treetops and attack their prey by dropping onto their heads from above.*

Part C

Survival! After the fire has been put out, the fire crews find a surviving baby dropbear after confusing it with a cylinder. (It is a well known mathematical fact that animals are often confused with simple geometric objects). Latest studies showed that the height of a dropbear $h(t)$ in centimetres after t weeks is given by:

$$h(t) = \frac{15}{2} \cdot \frac{5t + \sqrt{t} + 1}{t + 1}$$

While no such study has been done with the cross-section radius of a dropbear (because cutting them up would be unethical), empirical studies suggests that:

Time (wks)	1	2	3	4	5
Radius (cm)	8.75	10.4	11.5	12.4	13.2
Radius growth rate (cm/wk)	2	1.3	1	0.8	0.67

It is estimated that the baby dropbear can be released back into the wild after 4 weeks. Assuming the the bear has the density of water, how heavy will the dropbear be at that point in time? How fast is it growing at that point in time?