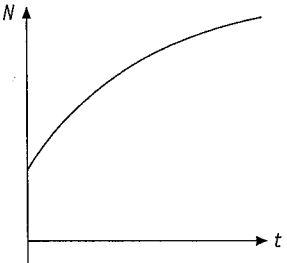
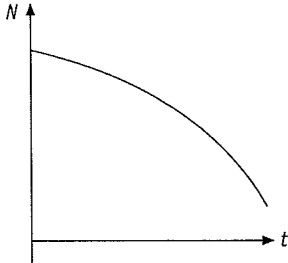
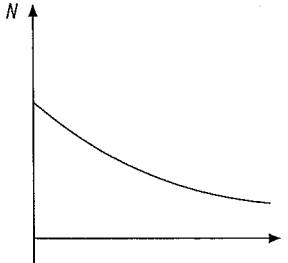
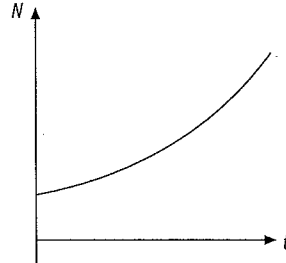


Applications of calculus to the physical world



Rates of change (1)

QUESTION 1 Fill in the correct inequality signs (< or >) for each diagram:

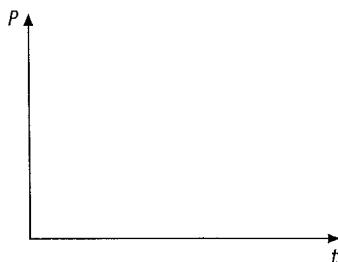
<p>a</p>  <p>$\frac{dN}{dt}$ _____ 0</p> <p>$\frac{d^2N}{dt^2}$ _____ 0</p>	<p>b</p>  <p>$\frac{dN}{dt}$ _____ 0</p> <p>$\frac{d^2N}{dt^2}$ _____ 0</p>	<p>c</p>  <p>$\frac{dN}{dt}$ _____ 0</p> <p>$\frac{d^2N}{dt^2}$ _____ 0</p>	<p>d</p>  <p>$\frac{dN}{dt}$ _____ 0</p> <p>$\frac{d^2N}{dt^2}$ _____ 0</p>
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QUESTION 2 The number of registered pets in a town, P , was studied over a period of time. At the beginning of this period there were 25 000 registered pets.

a Throughout the period $\frac{dP}{dt} > 0$. What does this say about the number of registered pets during the period?

b At the same time $\frac{d^2P}{dt^2} < 0$. What does this say about the number of pet registrations?

c Draw a possible sketch of P against t



Applications of calculus to the physical world



Rates of change (2)

QUESTION 1 The rate of change of volume V is given by $R = \frac{dV}{dt} = 1600t - t^3$ ($t \geq 0$). Find:

a R when $t = 0$

b t when $R = 0$

c an expression for V if $V = 1000$ when $t = 0$

d V when $t = 5$

QUESTION 2 Water is flowing through a filter at a variable rate given by $\frac{dV}{dt} = 90 - 5t$, where V is the volume in litres at time t minutes.

a At what rate is the water flowing after 10 minutes?

b When will the water cease flowing?

c How much water flows through the filter in this time?

Applications of calculus to the physical world



Rates of change (3)

QUESTION 1 In a factory, flour is poured into a biscuit mixture. The rate, in grams per second, at which the flour pours into the mixture is given by $R = 900t - t^3$ where t is the time in seconds.

a What is the rate at which the flour is being poured when $t = 5$?

_____	_____
_____	_____
_____	_____

b After how many seconds is there no longer any flour being poured?

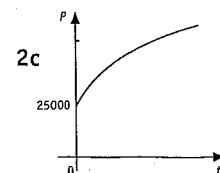
_____	_____
_____	_____
_____	_____

c How much flour is poured during the first 20 seconds?

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

d What is the maximum rate at which the flour pours into the mixture?

_____	_____
_____	_____
_____	_____
_____	_____



Page 123 1 a $>$, $<$ b $<$, $<$ c $<$, $>$ d $>$, $>$ 2 a The number of registered pets is increasing over the period. b The number of pet registrations is increasing at a decreasing rate. c (see right)

Page 124 1 a 0 b 0 or 40 c $V = 800t^2 - \frac{t^4}{4} + 1000$ d 20 843.75 2 a 40 L/min b after 18 minutes c 810 litres

Page 125 1 a 4375 grams per second b 30 seconds c 140 kg d $6000\sqrt{3}$ g/s