The above relationship between intake and volume or is a special case of a more general relationship between intake and volume, or can be shown in either case, and (2)-(3) always hold. In other words, (2) and (3) are equivalent.

\[ \text{Nevertheless, it is always still true that} \]
\[ (a) \Lambda = C \]
\[ (b) \int_{0}^{\infty} x^p \Lambda \ dx + C = \]
\[ (c) \int_{0}^{\infty} x^p \Lambda \ dx + C = (1) \Lambda \]

That \( \Lambda \) need not be known per se is known on [a], because the right-hand side of (2) depends on \( \phi \) and \( \Lambda \). We can emphasize determinants uniquely if \( C \) is known on [a], (2) fails to determine \( \Lambda \) uniquely if \( \Lambda \) is.

Although (2) to find volume we know intake, but the symmetry is imperfect. Although (1) to find intake if we know volume, and we use be obtained from the other. We use (1) to find intake if we know volume, and we use these relationships are symmetric to the extent that they enable either \( \Lambda \) or \( \phi \) to be substituted in either [a] or [b].

In Laplace notation, where \( x > a \). We have thus derived a pair of relationships.

\[ \text{In standard notation,} \]
\[ (c) \int_{0}^{\infty} x^p \Lambda \ dx + C = (1) \Lambda \]

This equation holds regardless of whether volume is increasing or decreasing during intake (0 > (1), \Lambda) and decrease volume during intake (0 < (1), \Lambda).

\[ (a) \Lambda = (1 + t/L)(\Lambda) \frac{\partial C}{\partial t} = (1) \Lambda \]

\[ \text{Therefore, we see in equation (1),} \]
\[ \text{be the corresponding not intake. } \]
\[ \text{Therefore, we see in equation (1),} \]

18. How fast a plant grow out to have a heart. The fundamental theorem.
and

\[ \frac{d}{dx} \int_a^b f(x) \, dx + C = f(x) \]

from Table 16.2, (8) and (17) immediately imply both

\[ \frac{d}{dx} \left( \frac{\int_a^b f(x) \, dx}{x} \right) = \frac{f(x)}{x} \]

(18.13)

Any function whose derivative is \( \frac{d}{dx} \) is called an antiderivative of \( f \). If \( f \) is not in

(18.12)

or

\[ (\int_0^1 f(x) \, dx) = (0) \]

on which the customary limits notation is used. For example, the predicted statements are

(18.11)

or

\[ \int \frac{d}{dx} \left( \int_0^x f(t) \, dt \right) \, dx = \int_0^x f(t) \, dt \]

unknown. If \( f \) is considered known, then (18.6) holds.

These expressions of the fundamental theorem are most applicable when \( f \) is

(18.10)

or

\[ (\int_0^x f(t) \, dt) = (x) \]

independent of a function's domain. So, in terms of information content,

Needless to say, a theorem's validity in no way depends on the symbol we choose for

(18.9)

where it is understood that

(18.8)

The equivalent statement in definite integral notation is

(18.7)

the theorem is a simple two-way implication:

In other words, the fundamental

Conversely, if \( f \) has domain \([a, b]\) and \( \Delta = (\int_a^b f(t) \, dt) \) then, \( f \) is defined in terms of \( \Delta \) on the same

[ borders removed for readability ]
(18.21) \[
\left\{ x^{\wedge \wedge} \frac{c}{p} \right\} = x^{\wedge}
\]

For example, because (16.17) and Exercise 17.4 yield

(18.20) \[
'(x)^{\Lambda} - (\Lambda)^{\Lambda} = \frac{\text{d}}{x} (\Lambda)^{\Lambda} = 1_p (\Lambda)^{\Lambda} \int_x
\]

which follows directly from (11)-(12). An equivalent statement is

(18.20a) \[
'(x)^{\Lambda} - (\Lambda)^{\Lambda} = \frac{\text{d}}{x} (\Lambda)^{\Lambda} = x_p (\Lambda)^{\Lambda} \int_x
\]

For calculating integrals by interpreting results about derivatives, we can most easily apply the fundamental theorem in the form

Some results that are equivalent by Leibniz's 16-17 and the fundamental theorem

Table 18.1

<table>
<thead>
<tr>
<th>Exercise 17.4</th>
<th>Constant</th>
<th>[ x^{\wedge \wedge} \frac{c}{p} = 1_p \int x^{\wedge \wedge} \frac{c}{p} ]</th>
<th>[ x^{\wedge \wedge} \frac{c}{p} = { x } \frac{x_p}{p} ]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>[ 0 &lt; a ]</td>
<td>[ 0 &gt; a ]</td>
</tr>
</tbody>
</table>

Table 18.2

<table>
<thead>
<tr>
<th>Exercise 17.2</th>
<th>Constant</th>
<th>[ \left[ 0 \right] ]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>[ \text{Antiderivative on } [a, b] ]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[ \text{Derivative on } [a, b] ]</td>
</tr>
</tbody>
</table>

Restrictions

Yields the more general result in Table 1; see Exercise 10.

Instead, that \( C = a \) is quite irrelevant if neither \( a \) nor \( C \) is known. Similar reasoning

(18.19) \[
\text{Constant} + \int x \frac{c}{I} = 1_p \int x
\]

so it is nearer to write

Because \( C \) is just an arbitrary constant, however, \( -C / \) is also just an arbitrary constant,

(18.18) \[
\frac{x}{C} - \int x \frac{c}{I} = 1_p \int x
\]

which agrees with (12.26). From (15), on the other hand, we have

(18.17) \[
\frac{a}{c} - \int x \frac{c}{I} = 1_p \int x
\]

From (16) and (12.25) we readily deduce that

(18.16) \[
\int x \frac{c}{I} = 1_p \int x
\]

A.W. Richetts-Clark's: "Calculus Lecture Notes."
partial pressures in the mathematical analysis that leads to this equation (1823). However, some errors on p. 121 of Alexander's discussion in particular, the common doctrine and medium, Note, 2 Alexander's (1990) Section 3.2 (pp. 119-122) is the primary source for the statement of this recipe. Note.

and concentration, is commonly known as Fick's law, where 9 is called the diffusion coefficient. Thus, the proportional relationship between flux,

\[
\frac{\partial P}{\partial x} = D
\]

unit area is a constant times the concentration gradient or is consistent with these observations to assume that the downward flux of oxygen per unit area is the concentration gradient is higher at higher levels than oxygen diffusion upward, whereas if \( \partial P/\partial x > 0 \) then \( P > 0 \). However, if \( \partial P/\partial x < 0 \) then \( P < 0 \) because oxygen concentration is higher at lower levels than oxygen diffusion upward, whereas if \( \partial P/\partial x > 0 \) then \( P > 0 \). Moreover, if \( \partial P/\partial x < 0 \) then \( P < 0 \), because the higher surface tension of the local gas pressure attributable to oxygen, for example, the partial pressure of oxygen at the arterial capillary is expressed in terms of its partial pressure, which is the partial pressure of oxygen and 78% nitrogen, with 1% trace elements. Accordingly, let \( P \) be the partial pressure of oxygen in the arterial capillary at 0.21 atm (because the arterial pressure is 0.21 atm), the higher the flow, the deeper the oxygen concentration gradient, the lesser the flow. By tradition, worlds, the deeper the concentration gradient, the lower oxygen concentration in regions of low oxygen from regions of diffusion upward. Now, diffusion of oxygen is simply flow of oxygen from region of x (ambient) at depth, x, and so \( -P(x) \) is the rate per unit area of change, per unit area of volume of oxygen transported downward per unit time (second), per unit area. Let \( P(x) \) be the rate per unit area (millimeters of water per oxygen at depth x diffusion downward, perpendicular to the arterial's dorsal surface (Fig. 2). That is, \( P(x) \) is the rate of change per unit area of oxygen at depth x diffusion downward. Therefore, let us consider the arterial wall as a vascular system.

To simplify this question, let us assume that the arterial wall has the form of a telescopic cylinder. Another question must be asked: How many layers of skin can a cylinder have? And, more specifically: How wide can a cylinder be? The solution to this question is slightly more complicated, since the cell issue is more than the surface area is on two opposite sides (so that as much of the surface area of the cell is needed to the surface area of the cell), but not quite. Why can I raise animals in this? The answer, of course, is that they are no cages they need. Without the help of a vascular system, they obtain all the oxygen they need by diffusion across the surface of their bodies from the surrounding respiratory medium. Many other useful results can be obtained in a similar way: see Exercises 19.

\[
\begin{align*}
\frac{1}{2} \wedge x \frac{\partial}{\partial x} \frac{\partial P}{\partial x} &= \frac{1}{2} \wedge \left[ \frac{1}{2} \wedge \frac{\partial P}{\partial x} \right] \\
\frac{1}{2} \wedge x \frac{\partial}{\partial x} \frac{\partial P}{\partial x} &= \frac{1}{2} \wedge \left[ \frac{1}{2} \wedge \frac{\partial P}{\partial x} \right] \\
\end{align*}
\]
\[
\begin{align*}
(1827) & 
\quad C = 0 + C = \mathcal{P} \left( s - \frac{1}{4} \right) \frac{b}{u} \int_0^\xi + C = 0 \Rightarrow y \\
(1826) & 
\quad \mathcal{P} \left( s - \frac{1}{4} \right) \frac{b}{u} \int_x^\xi + C = y \iff \left( s - x \right) \frac{b}{u} = \frac{xq}{\lambda_p}
\end{align*}
\]

Setting \( x = 0 \) yields

Theorem immediately provides the answer from (2.6) with \( a = 0 \), we have the fundamental

Figure 18.2

VENTRAL

\[ x = \xi \]

DORSAL

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>( s )</td>
</tr>
<tr>
<td>( z )</td>
</tr>
</tbody>
</table>

Note that, because \( x \leq s \) inside the cuboid, \( dy/dx \leq 0 \).

\[
(1825) \quad \left( s - x \right) \frac{b}{u} = \frac{xq}{\lambda_p}
\]

or

\[
(1824) \quad \left( x - s \right) m \frac{e}{m} = \left( \frac{xq}{\lambda_p} b - \right) e
\]

Let us assume that oxygen is supplied to the upper half of our feathers' body by diffusion across its dorsal surface, and to its lower half by diffusion across its ventral

Law E. Alexander (1990, pp. 120-131) suggests that a suitable value for feather tissue is

\[ q = 2 \times 10^{-5} \text{ mm}^2 \text{ atm}^{-1} \text{ s}^{-1} \]
We obtained in (12.27)-(28) by using integral thinking, i.e. by noting that (12.25) implies

\[ \int_x^0 \frac{b}{su} - \int_x^0 \frac{b}{sw} = \int_x^0 \frac{b}{w} \]

understand the difference better, it will be instructive to revise the result that

\[ \text{We conclude by noting that although versions (9) and (20) of the fundamental} \]

would have thickness's instead of \( z \).

because in that case the normal surface in Figure 2 would be at \( x = s \) (and the worm

then our analysis would predict an upper bound of 0.55 mm on thickness instead.

however, that if our Theorem could receive oxygen only through the dome surface,

thickness is never more than about 0.5 mm, less than half of our upper bound. Note,

thickness could possibly be more than 1.1 millimeters, which in \( z \), is

according to Alesander (1989, p. 119), 'the brain, consume oxygen at a rate in

accordance to Alesander (1989, p. 119), 'the brain, consume oxygen at a rate in

\[ \frac{w}{89y^m} \]
we will do so extensively henceforth.

Although we could have used (33) to obtain (22) as long ago as Lecture 8 (33) is

(1835) 

\[ \left( \frac{b}{w^2} - \frac{b}{\varepsilon} \right) = 1 \int \frac{b}{w^2} - \frac{b}{\varepsilon} \, \frac{1}{p} \right]_{P}^{0} = 1 \int (s-1) \frac{b}{w^2} \]

\( (s-1) \frac{b}{w^2} \quad 1 \cdot \frac{b}{w^2} - \frac{b}{\varepsilon} \cdot \frac{1}{p} \]

\( \{1\} \frac{b}{w^2} \cdot \frac{1}{p} \frac{b}{w^2} - \{1\} \frac{b}{w^2} \cdot \frac{1}{p} \]

Instead observe that (16.26) implies and using (12.26) to finish the job. To obtain the result by antiderivative thinking, we
where \( n \) is any positive integer and \( a < 0 \). \( \text{Hint: Use (11.12)}. \)

18.11 Use the fundamental theorem to show that

\[
(0, \infty): \quad \frac{d}{dx} \int_{-\infty}^{x} f(t) dt = f(x)
\]

where \( n \) is any positive integer. \( \text{Hint: Use (11.15)}. \)

18.10 Use another method (i)
with the help of Exercise 14.4.

Show that \( \int_{0}^{3} (6x^2 - 2x + 1) dx = 15 \)
for \( t \geq 3 \)

by another method (ii)
with the help of Exercise 14.3.

Show that \( \int_{0}^{2} (6x^2 - 2x + 1) dx = 20 \)
for \( t \geq 2 \)

18.8 Show that \( \int_{0}^{2} (6x^2 - 2x + 1) dx = 20 \)
for \( t \geq 2 \)

18.7 Show that \( \int_{0}^{2} (6x^2 - 2x + 1) dx = 20 \)
for \( t \geq 2 \)

18.6 Show that \( \int_{0}^{2} (6x^2 - 2x + 1) dx = 20 \)
for \( t \geq 2 \)

18.5 Show that \( \int_{0}^{2} (6x^2 - 2x + 1) dx = 20 \)
for \( t \geq 2 \)

18.4 Show that \( \int_{0}^{2} (6x^2 - 2x + 1) dx = 20 \)
for \( t \geq 2 \)

18.3 Show that \( \int_{0}^{2} (6x^2 - 2x + 1) dx = 20 \)
for \( t \geq 2 \)

18.2 Show that \( \int_{0}^{2} (6x^2 - 2x + 1) dx = 20 \)
for \( t \geq 2 \)

18.1 Show that \( \int_{0}^{2} (6x^2 - 2x + 1) dx = 20 \)
for \( t \geq 2 \)

Exercises 18
Write your answer as simply as possible.

\[ \int_{0}^{\infty} \exp \left( \frac{-z(\epsilon + x)}{2} \right) dz = \frac{\sqrt{\pi}}{\sqrt{\epsilon}} \left( 1 + \frac{1}{\epsilon} \right) \]

\[ \left( 1 + \frac{1}{\epsilon} \right) \left( 1 + \frac{1}{\epsilon} \right) = (4) \]

\[ \text{The function } C \text{ defined on } [0, \infty) \]

\[ \int_{z}^{\infty} \exp \left( \frac{-z(\epsilon + x)}{2} \right) dz = \frac{\sqrt{\pi}}{\sqrt{\epsilon}} \left( 1 + \frac{1}{\epsilon} \right) \]

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\[ \left( 1 + \frac{1}{\epsilon} \right) \left( 1 + \frac{1}{\epsilon} \right) = (4) \]

\[ \text{The function } C \text{ defined on } [0, \infty) \]
\[(\Pi \Lambda)^{\alpha} > \frac{\eta}{([\Pi + 1] \Lambda)^{\alpha}} > (\Pi + 1) \Lambda\]

\[(\Pi + 1) \Lambda = \frac{\eta}{([\Pi + 1] \Lambda)^{\alpha}} = (\Pi \Lambda)\]

\[(\Pi + 1) \Lambda > \frac{\eta}{([\Pi + 1] \Lambda)^{\alpha}} > (\Pi \Lambda)\]

Finally, if \(f(x)\) is increasing with \(\lambda \geq 0\) (bottom right), then \((\Pi + 1) \Lambda\) is constant (again). If \(f(x)\) is decreasing with \(\lambda \geq 0\) (bottom right), then \((\Pi + 1) \Lambda\) is constant (again). Then, because the shaded area must be bounded by the signed areas of the rectangles, we have the shaded area must be between the area of the dashed rectangle, we have the shaded area must be between the area of the dashed rectangle, we have the shaded area must be bounded by the area of the rectangles...
Then (A.15) implies $\Lambda \leq (i)$. As required.

be true if $D(\delta) \geq \delta$ if $g(1) = 0$, implying $\delta(1) = \delta(1)$. So $\delta$ is constant, say $\delta(1) = \delta$. The only way this can possibly

but (A.13) guarantees the existence of a constant $k$ such that $\delta \geq \delta(1)$. Hence

Then, in view of (11.1), (11.1), we have

Then, by the above argument with $H$ in place of $\Lambda$, we find that $H(1) = (i)\Lambda$.

that (A.7) holds, and define $H$ on $A \cup A$. So suppose

In the limit as $b \rightarrow 0^-$, and similarly for (A.11), see the footnote to Lecture 11.

So the right-hand side of (A.9) is $\delta(1)$, as required. Note that inequality (A.9) weakens to

only way this can happen is if

Now let $b \rightarrow 0$. Then, in all three cases, $\delta + b$ becomes arbritarily close to $\delta(1)$.
\[ \frac{(1-\varepsilon)Z}{(1+\varepsilon)(1-\varepsilon)} = \frac{1-\varepsilon}{\varepsilon-\varepsilon} = \frac{1-\varepsilon}{\varepsilon} \]

Thus, by version (20) of the fundamental theorem, we have

\[ \frac{(1-\varepsilon)Z}{(1-\varepsilon)} = \frac{1-\varepsilon}{\varepsilon} \]

as required. Why must the value be zero if \( t = 1 \)?

By Exercise 15.17 with \( b = \varepsilon \)

Thus, by version (20) of the fundamental theorem, we have

\[ \frac{(1-\varepsilon)Z}{(1-\varepsilon)} = \frac{1-\varepsilon}{\varepsilon} \]

as required.

By Exercise 13.17 with \( c = -1/\varepsilon \)

Thus, by version (20) of the fundamental theorem, we have

\[ \frac{(1-\varepsilon)Z}{(1-\varepsilon)} = \frac{1-\varepsilon}{\varepsilon} \]

as required.

By Exercise 16.17 with \( k \) and \( a = 0 \), we have

Thus, by version (20) of the fundamental theorem, we have

\[ \frac{(1-\varepsilon)Z}{(1-\varepsilon)} = \frac{1-\varepsilon}{\varepsilon} \]

as required. By Exercise 15.17 with \( b = \varepsilon \)

Thus, by version (20) of the fundamental theorem, we have

\[ \frac{(1-\varepsilon)Z}{(1-\varepsilon)} = \frac{1-\varepsilon}{\varepsilon} \]

as required.

By Exercise 16.17 with \( k \) and \( a = 0 \), we have

Thus, by version (20) of the fundamental theorem, we have

\[ \frac{(1-\varepsilon)Z}{(1-\varepsilon)} = \frac{1-\varepsilon}{\varepsilon} \]
\[
\frac{81}{9} = \left\{ \frac{81}{9} - \frac{9}{9} \right\} = \left\{ \frac{v}{1} - \left( \frac{2}{1} \right) \right\}
\]

Using the fundamental theorem,

\[
\frac{v}{1} = \left( \frac{1 + \frac{x}{v}}{1 - \frac{x}{v}} \right)
\]

So, on using the fundamental theorem,

\[
\left( \frac{1 + \frac{x}{v}}{1 - \frac{x}{v}} \right) = (1), C
\]

Hence, by the fundamental theorem,

\[
(1), C
\]

Extracting the leading term of the difference quotient, we have

\[
\frac{18}{6^v} = 0 - \left( \frac{6}{v} \right) = \left( \frac{1 + \frac{1}{v}}{1 - \frac{1}{v}} \right) - \left( \frac{1 + \frac{2}{v}}{1 - \frac{2}{v}} \right)
\]

\[
(1), C - (2) = \left( \frac{1 + \frac{x}{v}}{1 - \frac{x}{v}} \right)
\]

Extracting the leading term of the difference quotient, we have

\[
\left( \frac{1 + \frac{1}{v}}{1 - \frac{1}{v}} \right) = \left( \frac{1 + \frac{2}{v}}{1 - \frac{2}{v}} \right)
\]

As before,

\[
\left( \frac{1 + \frac{1}{v}}{1} \right) = \left( \frac{1 + \frac{2}{v}}{1} \right)
\]

Alternatively, by the fundamental theorem, we have

\[
(1 + \frac{1}{v}) = (1 + \frac{2}{v}) = (1 + \frac{3}{v}) = (1 + \frac{4}{v})
\]

50