Ordinary function.

This result is general: it applies to any
indefinite curve where f has no concavity. This includes curves of f and -f are always

increasing where f is positive and decreasing where f is negative. Conversely, the second
derivative of f can be used to determine the concavity of f.

For example, consider the function f(x) = x^3 - 3x. The first derivative f'(x) = 3x^2 - 3, which is zero at x = ±1. The second derivative f''(x) = 6x, which changes sign at x = 0. This indicates that f(x) is concave up for x < 0 and concave down for x > 0.

Similar considerations apply to trigonometric functions, whose equations are plotted in
Figure 2(b), directly below the graph of f(x) in Figure 2(a). (Notice how education
increases first, then decreases to a minimum, after which education increases again.

In the more abstract terms, a graph is concave up if its rate of increase is increasing, but
carries on.

It is now easy to see why you approach the terminal maximum at the end of the
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Although, for some purposes, we can describe a function accurately enough by identifying

3. Smoothness and concavity: a graphical perspective

...
\[
\begin{align*}
(3.1) & \quad 2 \geq 1 \geq 0 \quad \Rightarrow \quad 8.9788 + 0.0000 \cdot 2 \; & \quad 2 \geq 1 \geq 0 \quad \Rightarrow \quad 8.9788 + 0.0000 \cdot 2 \; \\
(3.2) & \quad H(t) = (t - 1.995 + 2.193t - 0.173) \\
(3.3) & \quad \frac{d}{dt} H(t) = 1.995 + 2.193t - 0.173.
\end{align*}
\]

where \( c = 30 \) is the global maximum, and \( s \) the piecewise-linear function defined on \([0, 12]\).

\( \frac{d}{dt} H(t) = 1.995 + 2.193t - 0.173 \)
because it is false.

Our question is answered: We write $c = 3.0$ because it is true, and we do not write $c = 3.8$.

We already know from Figure 3 that $c$ is approximately 3. So it now follows at once that

$$Z(c) = 0.02097569c + 9.6592(c - 0.00103)(c - 11.3616)(c - 0.00222).$$

Linear functions (Exercise 10):

Determine the exact value of $c$, we first rewrite the cubic polynomial $Z$ as a product of 3 factors that do not equal 0 (although the difference is small). Because

$$Z(c) = 6.8728 - 1.18356c - 0.09723c^2 + 0.02976c^3,$$

so that (5) implies

In the case of good size, (1) yields $F(c) = 1.997$, $F(c) - Z(c)$ and $G(c) = 8.8688$ and $C(c) = 8.9652$, where $Z$ is defined by

$$Z(c) = F(c) - C(c),$$

must satisfy $F(c) = C(c)$ or $Z(c) = 0$, where $Z$ is a function of $c$ (c) or $Z(c) = 0$ in (1) when one passes in coordinate space in terms of complexity: not only does $F$ have

in the lecture 2 that any join of the form

$W_y$, where it is true that $c = 3.0$ instead of $c = 3.0$. We have already observed

approximating real data, where is always a lack of agreement between smoothness and simplicity. Where the graphs have been produced in Schwarz's data. So $W$ is a better model than $S$. In

much less than the standard deviation in Schwarz's data. So $W$ is a better model than $S$. In

an extra component. But this formula is also very unreliable. Moreover, S and W differ by

because mean regular with changes smoothly. Perhap, but it is not possible on using in

on $[0, 0.2]$ means that a concept at $t = 3.0$. Does this mean that S is a true model,

the graph. If you have been modeled so you can see if $S$ is smooth enough representation of mean regular model. Can you tell the difference between

a substantial proportion of mean regular model. Can you see if $S$ is smooth

Either or W provides an excellent approximation to Schwarz's data, hence either or W is
Verify that (6) and (7) are identical.

Verify (6) if (7) holds for $g$ defined by (2)-(3).

A function $f$ is defined in Exercise 2.1. Is $f$ concave up, concave down, or neither?

3.2

3.3

3.4

3.5

3.6

3.7

3.8

3.9

Exercises
\[ s(t) = 0.02095964 \cdot 1 + (1.656 - 1.7866 + t^e) \]
\[ w(t) = 0.02095964 \cdot 1 + (1.871.656 - 1.7866 + t^e) \]

**Definition**

**Product Representation**

<table>
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<th>( c_1 )</th>
<th>( c_2 )</th>
<th>( c_3 )</th>
<th>( c_4 )</th>
<th>( c_5 )</th>
<th>( c_6 )</th>
<th>( c_7 )</th>
<th>( c_8 )</th>
<th>( c_9 )</th>
<th>( c_{10} )</th>
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</thead>
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</table>

\[ p(t) = c_0 + c_1 t + c_2 t^2 + c_3 t^3 + c_4 t^4 + c_5 t^5 \]

**Appendix 3**: Functions introduced in Lecture 3 join and products of polynomials.
The function is concave up throughout its domain (see Exercise 16.3).

3.3

is invertible on [0, 4], where it is decreasing, and [4, 10], where it is increasing. All possible answers have $f(4) = -3$, with either $f(0) = 5$ or $f(10) = 5$ (or both); and $f$ is increasing on [0, 8], concave up on [0, 5] and concave down on [5, 10].

3.4

In the simplest case, the function is increasing on [0, 3], decreasing on [3, 8].

3.2

In increasing and concave down.

Answers and Hints for Selected Exercises

3.1

we will show in a later lecture that $c = 4.3$, aproximately.

8.7, approximately; however, $W(c^*) = 2.1$, which exceeds $W(0) = 2.0$. So the global minimum is $W(0) = 7.0$. There is a local minimum at $c$, where $c^* = $...