Use the shortcut rules to **mentally** calculate the derivative of the given function.

*1.)*

*Problem f*(*x*) = 10*x*4

*f* *'*(*x*)=

2)

*Problem f*(*x*) = 8*x*4 + 8*x*3 − 4

|  |  |
| --- | --- |
| *f* *'*(*x*)= |  |

3.) Find the derivative of the function. HINT [See Examples 1 and 2.]

*h*(*x*) =

The price per barrel of crude oil in constant 2008 dollars can be approximated by

*P*(*t*) = 0.45*t*2 − 12*t* + 105 dollars. (0 ≤ *t* ≤ 28)

where *t* is time in years since the start of 1980.† Find *P'*(*t*) and *P'*(28).

|  |  |  |  |
| --- | --- | --- | --- |
| *P'*(*t*) = |  |  |  |
| *P'*(28) = | $ |  | per year |

4. ) What does the answer tell you about the price of crude oil? Hint [See Example 2.]

The price of a barrel of crude oil was increasing at a rate of $......... per year…….. in

 Fill in dots

5.) Find the marginal cost, marginal revenue, and marginal profit functions. HINT [See Example 2.]

*C*(*x*) = 3*x*;   *R*(*x*) = 6*x* − 0.001*x*2

|  |  |
| --- | --- |
| marginal cost     |  |
| marginal revenue     |  |
| marginal profit |  |

Find all values of *x* for which the marginal profit is zero. (Enter your answers as a comma-separated list.)

|  |  |
| --- | --- |
| X= |  |

6)

Suppose *P*(*x*) represents the profit on the sale of *x* DVDs. If

*P*(1,000) = 9,000

And *P'*(1,000) = −9, what do these values tell you about the profit?

*P*(1,000) represents the profit on the sale of…………… DVDs.

*P*(1,000) = 9,000, so the profit on the sale of DVDs is $......

*P'*(*x*) represents the

Select one marginal cost

marginal revenue

profit

rate of change of the profit as a function of *x*.

*P'*(1,000) = −9, so the profit is decreasing at the rate of $............. per additional DVD sold.

Your monthly profit (in dollars) from your newspaper route is given by

|  |  |
| --- | --- |
|  | *n* |

*` P* = 3*n* −

where *n* is the number of subscribers on your route. If you currently have 100 subscribers, find your profit and your marginal profit.

|  |  |
| --- | --- |
| profit     | $ |
| marginal profit     | $ per new subscriber |

Interpret your answers.

Your current profit is $........ per month and this would increase at a rate of $ per new subscriber.

The cost of producing *x* teddy bears per day at the Cuddly Companion Co. is calculated by their marketing staff to be given by the formula

*C*(*x*) = 100 + 39*x* − 0.03*x*2.

(a) Find the marginal cost function *C'*(*x*). HINT [See Example 1.]

|  |  |  |
| --- | --- | --- |
| *C'*(*x*) |  =  |  |

Use it to determine how fast the cost is going up at a production level of 100 teddy bears.

$ per teddy bear

Compare this with the exact cost of producing the 101st teddy bear.

The cost is increasing at a rate of $ per teddy bear. The exact cost of producing the 101st teddy bear is $ . Thus, there is a difference of $ .

(b) Find the average cost function

*C*,

and evaluate

*C*(100).

HINT [See Example 4.]

|  |  |
| --- | --- |
| *C*(*x*) = |  |
| *C*(100) = | $ per teddy bear |

What does the answer tell you?

The average cost of producing the first hundred teddy bears is $ per teddy bear.

For the cost function, find the marginal cost at the given production level *x*. State the units of measurement. (All costs are in dollars.) HINT [See Example 1.]

C(x)= 15,000 + 50x + 1000/x ; = 100

answer

*h*(*x*) = *x*(2 + 2*x*)

(a) Calculate the derivative of the given function without using either the product or quotient rule.

|  |  |
| --- | --- |
| *h'*(*x*) = |  |

(b) Use the product or quotient rule to find the derivative. Check that you obtain the same answer. HINT [See Quick Examples on page 314.]

|  |  |
| --- | --- |
| *h'*(*x*) = |  |

Calculate

*Dy*/*dx*

.

Simplify your answer. HINT [See Example 5.]

*y* = *x*3(7 − *x*2)

|  |  |
| --- | --- |
| *Dy*/*dx*= |  |

Calculate *dy*/*dx*

.

You need not expand your answer.

*y* = (*x* + 9)(*x*2 − 9)

|  |  |  |
| --- | --- | --- |
| *Dy*/*dx* | = |  |

Compute the derivative.

 *d*/*dx*

[(*x*3 + 6*x*)(*x*2 − *x*)]

 x=2

answer

The spot price of crude oil during the period 2000-2005 can be approximated by

*P*(*t*) = 5*t* + 25 dollars per barrel    (0 ≤ *t* ≤ 5)

in year *t*, where *t* = 0 represents 2000. Saudi Arabia's crude oil production over the same period can be approximated by

*Q*(*t*) = 0.082*t*2 − 0.22*t* + 8.2 million barrels per day†    (0 ≤ *t* ≤ 5)

Use these models to estimate Saudi Arabia's daily oil revenue and also its rate of change in 2005. (Round your answers to the nearest $1 million.)

|  |  |
| --- | --- |
| daily oil revenue     | $ million |
| rate of change in 2005     | $ million/yr |