Practice Problems

6. Derivatives

Find the derivative of the following:

1. $f(x) = 1 + 4x - 5x^2$

2. $g(t) = (t^2 - 3)(t^2 + 3)$

3. $h(x) = x + x^3 - x^2$

7. Partial Derivatives

Find the derivative of the following with respect to *x* and with respect to *y*:

1. $f(x, y) = 2x + 3y$

2. $f(x, y) = 3xy^2 - 2x^2y$

3. $f(x, y) = x + 2x^{1/2}y^{1/2} + y$

9. Level Sets (Indifference curves)

Megan only cares about coffee and doughnuts and her happiness is determined by the following utility function:

$$u(d,c) = \begin{cases} 3d + c & \text{if } c > d \\ d + 3c & \text{if } c < d \end{cases}$$

where c and d represent how many coffee and doughnuts Megan consumes. The price of coffee is $2 and the price of doughnuts is $1. Megan's income is $6.

a. Draw Megan's budget line
b. In a separate diagram, draw Megan's indifference curve when her utility level is equal to 9.

Answers to Practice Problems

6. Derivatives

1. $f'(x) = 4 - 10x$

2. $$\begin{aligned} g'(t) &= 2t(t^2 + 3) + (t^2 - 3)2t \\ &= 2t\left[(t^2 + 3) + (t^2 - 3)\right] \\ &= 2t\left[2t^2\right] \\ &= 4t^3 \end{aligned}$$

3. $h'(x) = 1 + 3x^2 - 2x$

7. Partial Derivatives

1. $f_x = 2$
   $f_y = 3$

2. $f_x = 3y^2 - 4xy$
   $f_y = 6xy - 2x^2$

3. $f_x = 1 + \dfrac{y^{1/2}}{x^{1/2}}$
   $f_y = 1 + \dfrac{x^{1/2}}{y^{1/2}}$