

How to Administer the Quick Check:

- The Quick Check consists of two parts: an Instructor portion which includes solutions and a Student portion with problems for each concept.
- **Your student need only complete the Quick Check problems for the concepts for which you responded **Unsure**.**
- Have your student complete the Quick Check items independently. You may attempt to clarify the wording of a question, but you should not provide hints about how to solve a problem.
- Return to the Question Block when you have checked your student's work.
- *You should now be able to answer **Yes** or **No** for each question.*
- Click **Next** to go to the next screen.

13.1 Can my student differentiate equations?

13.1a Find $\frac{dw}{dx}$ given $w = \frac{4}{\sqrt{x}}$.

$$\frac{dw}{dx} = -\frac{1}{2}x^{-\frac{3}{2}} \text{ or } -\frac{1}{2\sqrt{x^3}}$$

To find the derivative use the power rule after changing $\sqrt{x}$ to $x^{-\frac{1}{2}}$

$$\frac{d}{dx} 4x^{-\frac{1}{2}}$$

$$4 \frac{d}{dx} x^{-\frac{1}{2}}$$

$$4\left(-\frac{1}{2}\right)(x^{-\frac{1}{2}-1})$$

$$-2x^{-\frac{3}{2}}$$

13.1b Find f'' given $f(x) = \sin(x) + 3x^2$

$$-\sin x + 6$$

$$f'(x) = \cos x + 6x$$

$$f'' = -\sin x + 6$$



13.2

Can my student apply the Chain Rule?

13.2a

Find $\frac{dy}{dx}$ given $y = 1 - u^2$ and $u = 2x$

$$\frac{dy}{dx} = -8x$$

To find the derivative, remember $\frac{dy}{du} \left(\frac{du}{dx} \right) = \frac{dy}{dx}$

First find $\frac{dy}{du} = -2u$

$$\frac{du}{dx} = 2$$

Multiply: $-4u = -4(2x) = -8x$

$$\frac{dy}{dx} = -8x$$

13.2b

Find $\frac{dy}{dx}$ given $y = 4u^2$, $u = 3 - 2t$, $t = 2x$

$$\frac{dy}{dx} = -96 + 128x$$

$$\frac{dy}{du} \frac{du}{dt} \frac{dt}{dx} = \frac{dy}{dx}$$

$$\frac{dy}{du} = 8u$$

$$\frac{du}{dt} = -2$$

$$\frac{dt}{dx} = 2$$

$$(8u)(-2)(2) = -32u = -32(3 - 2t) = -96 + 64t = -96 + 64(2x) = -96 + 128x$$

**13.3 Can my student integrate equations?**

13.3a

Integrate $\int 3x^2(2 - x^3)dx$

$$2x^3 - \frac{1}{2}x^6$$

$$\text{Let } u = x^3 \frac{du}{dx} = 3x^2$$

$$du = 3x^2 dx$$

$$\text{Substitute in the equation } \int (2 - u) du = 2u - \frac{1}{2}u^2$$

Plug in x^3 for u ,

$$2x^3 - \frac{1}{2}x^6$$

13.3b

Integrate $\int_{-1}^2 -y^2 + y + 2dy$

$$4\frac{1}{2} \text{ or } 4.5$$

$$-\frac{1}{3}y^3 + \frac{1}{2}y^2 + 2y \text{ from } -1 \text{ to } 2$$

$$-\frac{1}{3}(2)^3 + \frac{1}{2}(2)^2 + 2(2) - \left[-\frac{1}{3}(-1)^3 + \frac{1}{2}(-1)^2 + 2(-1)\right]$$

$$-\frac{8}{3} + 2 + 4 - \left[\frac{1}{3} + \frac{1}{2} - 2\right]$$

$$6 - \frac{8}{3} - \frac{1}{3} - \frac{1}{2} + 2$$

$$= \frac{9}{2} \text{ or } 4\frac{1}{2} \text{ or } 4.5$$



13.4

Can my student apply the Mean Value Theorem and L'Hôpital's Rule?

13.4a

Evaluate $\lim_{x \rightarrow 0} \frac{x^2 + \cos(x)}{2x}$ **0**Take the derivative of the numerator $f(x)$ and the denominator $g(x)$.

$$f'(x) = 2x - \sin(x)$$

$$g'(x) = 2$$

$$\lim_{x \rightarrow 0} \frac{2x - \sin(x)}{2} = \frac{0 + 0}{2} = 0$$

13.4b

Find a value of c which satisfies the MVT for $f(x) = \sqrt{x-1}$ on $[1, 5]$? **$x = 2$** For the point $x = 1, f(x) = 0$ For the point $x = 5, f(x) = 2$ The slope is $\frac{(2-0)}{(5-1)} = \frac{2}{4} = \frac{1}{2}$ Find the derivative of $f(x) = \sqrt{x-1} = (x-1)^{\frac{1}{2}}$

$$f'(x) = \frac{1}{2}(x-1)^{-\frac{1}{2}} = \frac{1}{2\sqrt{x-1}}$$

$$\frac{1}{2\sqrt{x-1}} = \frac{1}{2}$$

$$\sqrt{x-1} = 1$$

$$x - 1 = 1$$

$$x = 2, \text{ so } c = 2$$



13.5

Can my student solve differential equations?

13.5a

Solve $\frac{dy}{dx} = e^y \sin(x)$ for x

$$y = -\ln[\cos(x) + C]$$

$$dy = e^y \sin(x) dx$$

$$\frac{dy}{e^y} = \sin(x) dx$$

$$\int \frac{dy}{e^y} = \int \sin(x) dx$$

$$e^{-y} dy = \sin(x) dx$$

$$\text{Let } u = -y$$

$$du = -1 dy$$

$$-1 du = dy$$

$$\int -1 e^u du = \int \sin(x) dx$$

$$-1 e^u = -\cos(x) + C$$

$$e^u = \cos(x) + C$$

$$\ln(e^u) = \ln[\cos(x) + C]$$

$$u = \ln[\cos(x) + C]$$

$$-y = \ln[\cos(x) + C]$$

$$y = -\ln[\cos(x) + C]$$



13.5

Can my student solve differential equations?

13.5b

Solve $\frac{dy}{dx} \cos(2x) = \sin(2x)$ when $y(0) = 1$

$$c = 1$$

$$dy = \frac{\sin(2x)}{\cos(2x)} dx$$

$$\int dy = \int \frac{\sin(2x)}{\cos(2x)} dx$$

$$\text{Let } u = \cos(2x)$$

$$du = -2\sin(2x)dx$$

$$-\frac{1}{2}du = \sin(2x)dx$$

$$\int dy = \int -\frac{1}{2} \frac{1}{u} du$$

$$y = -\frac{1}{2}\ln(u) + C$$

$$y = -\frac{1}{2}\ln[\cos(2x)] + C$$

$$\text{When } y(0) = 1$$

$$1 = -\frac{1}{2}\ln\{\cos[2(0)]\} + C$$

$$1 = -\frac{1}{2}\ln[\cos(0)] + C$$

$$1 = -\frac{1}{2}\ln[\cos(0)] + C$$

$$1 = -\frac{1}{2}\ln(1) + C$$

$$1 = -\frac{1}{2}(0) + C$$

$$1 = C$$

How to complete the Quick Check:

- You only need to complete the problems your parent or instructor assigns.

13.1

13.1a

Find $\frac{dw}{dx}$ given $w = \frac{4}{\sqrt{x}}$.

13.1b

Find f'' given $f(x) = \sin(x) + 3x^2$

13.2

13.2a Find $\frac{dy}{dx}$ given $y = 1 - u^2$ and $u = 2x$

13.2b Find $\frac{dy}{dx}$ given $y = 4u^2$, $u = 3 - 2t$, $t = 2x$



13.3

13.3a

Integrate $\int 3x^2(2 - x^3)dx$

13.3b

Integrate $\int_{-1}^2 -y^2 + y + 2dy$

13.4

13.4a

Evaluate $\lim_{x \rightarrow 0} \frac{x^2 + \cos(x)}{2x}$

13.4b

Find a value of c which satisfies the MVT for $f(x) = \sqrt{x-1}$ on $[1, 5]$?



13.5

13.5a

Solve $\frac{dy}{dx} = e^y \sin(x)$ for x

13.5

13.5b

Solve $\frac{dy}{dx} \cos(2x) = \sin(2x)$ when $y(0) = 1$