Question (number) - q matrix inverse

Version 1
Matrix inverse

(1) **(4 points)** What is the inverse of $\begin{bmatrix} -6 & 3 \\ -5 & 2 \end{bmatrix}$?

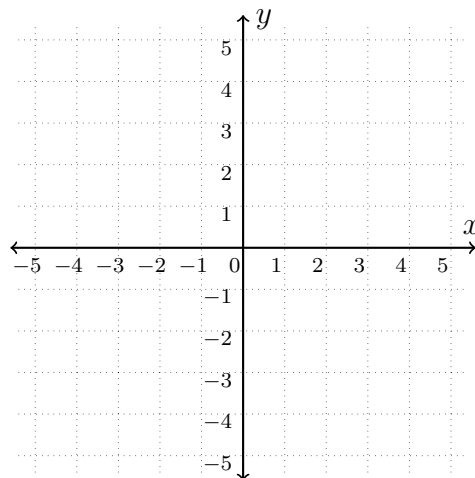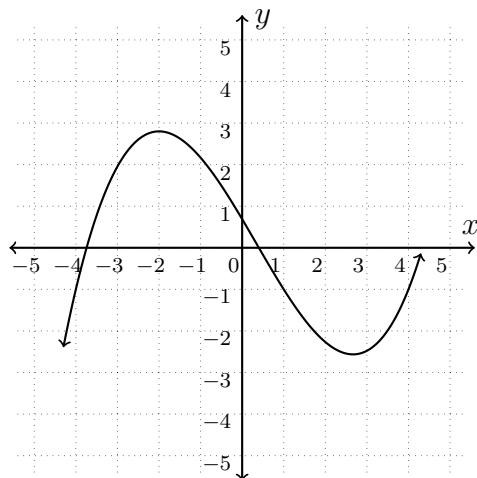## Question (number) - q polynomial derivative

Version 1
Polynomial derivative

(2) **(4 points)** What is the derivative of $5x^3 - 8x^2 - 12x + 7$?

Question (number) - q derivative sketch

Version 1

Derivative graphing

(3) **(4 points)** Sketch the derivative of the function $f(x)$.

Question (number) - q related rates

Version 1
Related rates

(4) **(4 points)** A particle is moving along the curve $xy = 2$. As the particle passes through the point $(2, 1)$, it's x-coordinate increases at a rate of 3cm/sec.
(a) How fast is the y-value of the particle changing at this instant?

(b) What is the distance of the particle to the origin at this instant?

(c) How fast is the distance from the particle to the origin changing at this instant?

Version 2
Learning goal 4

(5) **(4 points)** A particle is moving along the curve $x^2 + 4y^2 = 8$. As the particle passes through the point $(2, 1)$, it's x-coordinate increases at a rate of 3cm/sec.
(a) How fast is the y-value of the particle changing at this instant?

(b) What is the distance of the particle to the origin at this instant?

(c) How fast is the distance from the particle to the origin changing at this instant?

Version 3
Learning goal 4

(6) **(4 points)** A particle is moving along the curve $x^2 - 4y^2 = 0$. As the particle passes through the point $(2, 1)$, it's x-coordinate increases at a rate of 3cm/sec.
(a) How fast is the y-value of the particle changing at this instant?

(b) What is the distance of the particle to the origin at this instant?

(c) How fast is the distance from the particle to the origin changing at this instant?

Question (number) - q absolute limit

Version 1
Limits of piecewise functions

(7) **(4 points)** Complete the piecewise function, and use that to evaluate the given limit.

$$|5 - t| = \begin{cases} & \text{when } t \geq 5 \\ \\ & \text{when } t < 5 \end{cases}$$

$$\lim_{t \to 5^+} \frac{4|5 - t|}{(5 - t)}$$

Version 2
Learning goal 13

(8) **(4 points)** Complete the piecewise function, and use that to evaluate the given limit.

$$|5 - t| = \begin{cases} & \text{when } t \geq 5 \\ \\ & \text{when } t < 5 \end{cases}$$

$$\lim_{t \to 5^+} \frac{4|5 - t|}{(t - 5)}$$

Version 3
Learning goal 13

(9) **(4 points)** Complete the piecewise function, and use that to evaluate the given limit.

$$|t - 5| = \begin{cases} & \text{when } t \geq 5 \\ \\ & \text{when } t < 5 \end{cases}$$

$$\lim_{t \to 5^-} \frac{4|t - 5|}{(5 - t)}$$

Version 4
Learning goal 13

(10) **(4 points)** Complete the piecewise function, and use that to evaluate the given limit.

$$|t - 5| = \begin{cases} & \text{when } t \geq 5 \\ \\ & \text{when } t < 5 \end{cases}$$

$$\lim_{t \to 5^-} \frac{4|t - 5|}{(t - 5)}$$

Question (number) - q rational limits

Version 1

Limits of unsimplified rational function

(11) **(4 points)** Evaluate the following limit.
$$\lim_{x \to 4} \frac{x^2 - 5x + 4}{6x - 24}$$

Version 2

Learning goal 12

(12) **(4 points)** Evaluate the following limit.
$$\lim_{x \to 4} \frac{6x - 24}{x^2 - 5x + 4}$$

MATH 1001 - Midterm 1 - Grading guide

Question (number) - q radical limits

Version 1
Limits with radicals

(13) **(4 points)** Consider the limit $\lim\limits_{x \to 1} \dfrac{\sqrt{x^2} - \sqrt{4x - 3}}{x - 1}$.

    (a) What is the conjugate of the numerator?

    (b) Evaluate the limit.

Question (number) - q exponential derivative

Version 1
Exponential derivatives

(14) **(4 points)** Compute $\frac{dy}{dx}$ for $y = x^{x^3 + 4\sin(x)}$.

Version 2
Learning goal 10

(15) **(4 points)** Compute $\frac{dy}{dx}$ for $y = x^{x^3 + 4\cos(x)}$.

Version 3
Learning goal 10

(16) **(4 points)** Compute $\frac{dy}{dx}$ for $y = x^{e^{3x} + 4\sin(x)}$.

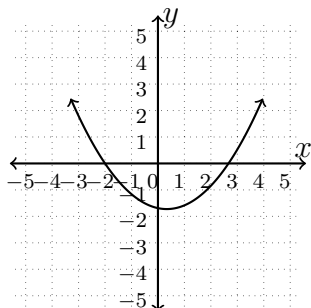**Version 4**
Learning goal 10

(17) **(4 points)** Compute $\frac{dy}{dx}$ for $y = x^{e^{3x} + 4\cos(x)}$.

Solutions:

(1) $\frac{1}{3}\begin{bmatrix} 2 & -3 \\ 5 & -6 \end{bmatrix} = \begin{bmatrix} \frac{2}{3} & -1 \\ \frac{5}{3} & -2 \end{bmatrix}$

(2) $15x^2 - 16x - 12$

(3)

(4) (a) $-\frac{x'y}{x} = -\frac{3\cdot 1}{2}$

   (b) $\sqrt{5}$

   (c) $\frac{2xx'+2yy'}{2\sqrt{x^2+y^2}} = \frac{1}{2\sqrt{5}}\cdot 9$

(5) (a) $-\frac{xx'}{4y} = -\frac{2\cdot 3}{4\cdot 1}$

   (b) $\sqrt{5}$

   (c) $\frac{2xx'+2yy'}{2\sqrt{x^2+y^2}} = \frac{1}{2\sqrt{5}}\cdot 9$

(6) (a) $\frac{xx'}{4y} = \frac{2\cdot 3}{4\cdot 1}$

   (b) $\sqrt{5}$

   (c) $\frac{2xx'+2yy'}{2\sqrt{x^2+y^2}} = \frac{1}{2\sqrt{5}}\cdot 15$

(7) $\begin{cases} -(5-t) & \text{when } t \geq 5 \\ 5-t & \text{when } t < 5 \end{cases}, -4$

(8) $\begin{cases} -(5-t) & \text{when } t \geq 5 \\ 5-t & \text{when } t < 5 \end{cases}, 4$

(9) $\begin{cases} t-5 & \text{when } t \geq 5 \\ -(t-5) & \text{when } t < 5 \end{cases}, 4$

(10) $\begin{cases} t-5 & \text{when } t \geq 5 \\ -(t-5) & \text{when } t < 5 \end{cases}, -4$

(11) $\frac{3}{6} = \frac{1}{2}$

(12) $\frac{6}{3} = 2$

(13) (a) $\sqrt{x^2} + \sqrt{4x-3}$

   (b) $\frac{-2}{2\sqrt{1}}$

(14) $\left(x^{x^3+4\sin(x)}\right)\left((3x^2 + 4\cos(x))\ln(x) + \frac{x^3+4\sin(x)}{x}\right)$

(15) $\left(x^{x^3+4\cos(x)}\right)\left((3x^2 - 4\sin(x))\ln(x) + \frac{x^3+4\cos(x)}{x}\right)$

(16) $\left(x^{e^{3x}+4\sin(x)}\right)\left((3e^{3x} + 4\cos(x))\ln(x) + \frac{e^{3x}+4\sin(x)}{x}\right)$

(17) $\left(x^{e^{3x}+4\cos(x)}\right)\left((3e^{3x}-4\sin(x))\ln(x)+\frac{e^{3x}+4\cos(x)}{x}\right)$