

PART I: PRE-CALCULUS

Question 1  $\left(-\frac{3}{5} + \frac{3}{2}\right)^{-2} = \boxed{\frac{100}{81}}$  ← (Simplify)

Question 2 Between which two consecutive integers is each of the following numbers?

$\boxed{-2} < -1.83 < \boxed{-1}$

$\boxed{6} < \sqrt{40} < \boxed{7}$

$\boxed{21} < \sqrt{40} + \overset{15}{\llbracket 5\pi \rrbracket} < \boxed{22}$

Question 3 Let  $f(x) = |-x|$ .  $f(-12) = \boxed{12}$   $f\left(\frac{110}{7}\right) = \boxed{\frac{110}{7}}$  True or False?:  $|-x| = x$   $\boxed{F}$

Question 4 Simplify  $\sqrt{(x^3 + 1)^2 + 2x^3 + 3}$  as far as possible.

$\boxed{\sqrt{x^6 + 4x^3 + 4}}$  OR  $x^3 + 2$  (when  $x^2 + 2 \geq 0$ )

PART II: FUNCTIONS AND LINES

Question 5 Let  $g(x) = \frac{1}{x^3 + 1}$ . What is the domain of  $g$ ?  $D_g = (-\infty, -1) \cup (-1, \infty)$  ← (same!)

What is the inverse function?

$g^{-1}(x) = \boxed{\sqrt[3]{\frac{1}{x} - 1}}$

What is its range?

$R_{g^{-1}} = (-\infty, -1) \cup (-1, \infty)$

Question 6 Find an equation for the line through  $P = (1, 1)$  with slope  $3/4$ .

$\boxed{y = \frac{3}{4}x + \frac{1}{4}}$

Find another point  $Q$  on the same line.

$Q = \boxed{(5, 4)}$   
(or ...)

What is the distance between  $P$  and  $Q$ ?

$d(P, Q) = \boxed{5}$   
(or ...)

PART III: LIMITS, CONTINUITY, ASYMPTOTES

Question 7 For each of the following limits, first evaluate the limit.

Then, for each, list all the vertical and horizontal asymptotes which are guaranteed from your answer alone. (If neither kind, write "none.")

$\lim_{x \rightarrow 1} \frac{x^2 + x - 2}{x - 1} = \boxed{3}$   $\boxed{\text{none}}$

$\lim_{x \rightarrow \infty} \frac{x^2 + 3}{\sqrt{x} + 1} = \boxed{\infty}$   $\boxed{\text{none}}$

$\lim_{x \rightarrow 5^-} \frac{2^x}{1 - x} = \boxed{-8}$   $\boxed{\text{none}}$

$\lim_{x \rightarrow -\infty} \frac{35x^5 + x^3 + 10000}{x^6 - 1} = \boxed{0}$   $\boxed{\text{horiz. asympt. at } y=0}$

$\lim_{h \rightarrow 0} \frac{(x+h)^2 - x^2}{h} = \boxed{2x}$   $\boxed{\text{none}}$

$\lim_{x \rightarrow \boxed{10}} \frac{1}{(x-10)^2} = \boxed{\infty}$   $\boxed{\text{vertical asymptote at } x=10}$

(for example)

Question 8 Find a rational function  $f(x)$  whose graph is the same as the graph of  $g(x) = x^2 + 2$  except that it has a removable discontinuity at  $x = 3$ .

$f(x) = \frac{(x^2 + 2)(x - 3)}{(x - 3)}$

PART I: PRE-CALCULUS

Question 1  $\left(-\frac{3}{4} + \frac{4}{3}\right)^{-2} = \boxed{\frac{144}{49}}$  ← (simplify)

Question 2 Between which two consecutive integers is each of the following numbers?

$\boxed{-3} < -2.04 < \boxed{-2}$

$\boxed{7} < \sqrt{60} < \boxed{8}$

$\boxed{22} < \sqrt{60} + \overset{15}{\text{in}} \llbracket 5\pi \rrbracket < \boxed{23}$

Question 3 Let  $f(x) = |-x|$ .  $f(-12) = \boxed{12}$   $f\left(\frac{110}{7}\right) = \boxed{\frac{110}{7}}$  True or False?:  $|-x| = x$   $\boxed{F}$

Question 4 Simplify  $\sqrt{(x^3 + 2)^2 + 2x^3 + 5}$  as far as possible.  $\boxed{\sqrt{x^6 + 6x^3 + 9}}$  OR  $\boxed{x^3 + 3}$  (when  $x^3 + 3 \geq 0$ )

PART II: FUNCTIONS AND LINES

Question 5 Let  $g(x) = \frac{2}{x^3 + 1}$ . What is the domain of  $g$ ?  $D_g = \boxed{(-\infty, -1) \cup (-1, \infty)}$  ← (same!)

What is the inverse function?  $g^{-1}(x) = \boxed{\sqrt[3]{\frac{2}{x} - 1}}$  What is its range?  $R_{g^{-1}} = \boxed{(-\infty, -1) \cup (-1, \infty)}$

Question 6 Find an equation for the line through  $P = (2, 2)$  with slope  $3/4$ .  $\boxed{y = \frac{3}{4}x + \frac{1}{2}}$

Find another point  $Q$  on the same line.  $Q = \boxed{(6, 5)}$  (for example) What is the distance between  $P$  and  $Q$ ?  $d(P, Q) = \boxed{5}$  ← (in this case)

PART III: LIMITS, CONTINUITY, ASYMPTOTES

Question 7 For each of the following limits, first evaluate the limit. Then, for each, list all the vertical and horizontal asymptotes which are guaranteed from your answer alone. (If neither kind, write "none.")

$\lim_{x \rightarrow 1} \frac{x^2 + 2x - 3}{x - 1} = \boxed{4}$	$\boxed{\text{none}}$	$\lim_{x \rightarrow 5^-} \frac{2^x}{1 - x} = \boxed{-8}$	$\boxed{\text{none}}$
$\lim_{x \rightarrow \infty} \frac{x^2 + 3}{\sqrt{x} + 1} = \boxed{\infty}$	$\boxed{\text{none}}$	$\lim_{x \rightarrow -\infty} \frac{35x^5 + x^3 + 10000}{x^6 - 1} = \boxed{0}$	$\boxed{\text{horizontal asymp. at } y=0}$
$\lim_{h \rightarrow 0} \frac{(x+h)^2 - x^2}{h} = \boxed{2x}$	$\boxed{\text{none}}$	$\lim_{x \rightarrow 10^+} \frac{5}{x-10} = \boxed{\infty}$	$\boxed{\text{vertical asymptote at } x=10}$

(for example)

Question 8 Find a rational function  $f(x)$  whose graph is the same as the graph of  $g(x) = 3x^2 + 1$  except that it has a removable discontinuity at  $x = 2$ .

$f(x) = \boxed{\frac{(3x^2 + 1)(x - 2)}{(x - 2)}}$

# ANSWERS

## PART I: PRE-CALCULUS

Question 1  $\left(-\frac{2}{5} + \frac{1}{4}\right)^{-2} = \boxed{\frac{400}{9}}$  ← (simplify)

Question 2 Between which two consecutive integers is each of the following numbers?

$\boxed{-5} < -4.88 < \boxed{-4}$

$\boxed{8} < \sqrt{77} < \boxed{9}$

$\boxed{23} < \sqrt{77} + \overset{15}{\text{''}} \underbrace{[[5\pi]]} < \boxed{24}$

Question 3 Let  $f(x) = |-x|$ .  $f(-12) = \boxed{12}$   $f\left(\frac{110}{7}\right) = \boxed{\frac{110}{7}}$  True or False?:  $|-x| = x$   $\boxed{F}$

Question 4 Simplify  $\sqrt{(x^3 + 2)^2 - 2x^3 - 3}$  as far as possible.  $\boxed{\sqrt{x^6 + 2x^3 + 1}}$  OR  $\boxed{x^3 + 1}$  (when  $x^3 + 1 \geq 0$ )

## PART II: FUNCTIONS AND LINES

Question 5 Let  $g(x) = \frac{3}{x^3 + 1}$ . What is the domain of  $g$ ?  $D_g = \boxed{(-\infty, -1) \cup (-1, \infty)}$  ← (same!)

What is the inverse function?  $g^{-1}(x) = \boxed{3\sqrt{\frac{3}{x} - 1}}$  What is its range?  $R_{g^{-1}} = \boxed{(-\infty, -1) \cup (-1, \infty)}$

Question 6 Find an equation for the line through  $P = (2, 1)$  with slope  $3/4$ .  $\boxed{y = \frac{3}{4}x - \frac{1}{2}}$

Find another point  $Q$  on the same line.  $Q = \boxed{(6, 4)}$  What is the distance between  $P$  and  $Q$ ?  $d(P, Q) = \boxed{5}$   
(for example) ← (in this case)

## PART III: LIMITS, CONTINUITY, ASYMPTOTES

Question 7 For each of the following limits, first evaluate the limit. Then, for each, list all the vertical and horizontal asymptotes which are guaranteed from your answer alone. (If neither kind, write "none.")

$\lim_{x \rightarrow 1} \frac{x^2 - x - 2}{x - 1} = \boxed{DNE}$	$\boxed{\text{vertical asymptote at } x=1}$	$\lim_{x \rightarrow -\infty} \frac{35x^5 + x^3 + 10000}{x^6 - 1} = \boxed{0}$	$\boxed{\text{horiz. asymptote at } y=0}$
$\lim_{x \rightarrow 5^-} \frac{2^x}{1 - x} = \boxed{-8}$	$\boxed{\text{none}}$	$\lim_{x \rightarrow \infty} \frac{x^2 + 3}{\sqrt{x} + 1} = \boxed{\infty}$	$\boxed{\text{none}}$
$\lim_{h \rightarrow 0} \frac{(x+h)^2 - x^2}{h} = \boxed{2x}$	$\boxed{\text{none}}$	$\lim_{x \rightarrow 10^-} \frac{x}{10-x} = \boxed{\infty}$	$\boxed{\text{vertical asymptote at } x=10}$

(for example)

Question 8 Find a rational function  $f(x)$  whose graph is the same as the graph of  $g(x) = x^2 - 2$  except that it has a removable discontinuity at  $x = 2$ .

$f(x) = \boxed{\frac{(x^2 - 2)(x - 2)}{(x - 2)}}$