Question 1: Expand and simplify: $(1 + 2x)(x^2 - 3x + 1)$

[3]

Question 2: Express as a single simplified fraction: $u + 1 + \dfrac{u}{u+1}$

[3]

Question 3: Simplify: $\left(\dfrac{\sqrt{xy}}{x^4}\right)\left(\dfrac{9y^{4/3}}{(3xy)^3}\right)$

[4]

Question 4: Express as a single simplified fraction: $\dfrac{x}{x^2 - 16} - \dfrac{x - 2}{x^2 + 3x - 4}$

[3]

Question 5: Rationalize and simplify: $\sqrt{x^2 + x} - \sqrt{x^2 - x}$

[4]

Question 6: The lines $ax + 3y + p = 0$ and $7x + by + q = 0$ are perpendicular (here a, b, p, q are constants). Determine $\dfrac{a}{b}$.

[3]

Question 7: Determine $\tan(7\pi/4) - \csc(2\pi/3)$. Express your answer as a single simplified fraction.

[3]

Question 8: Find all values of x in the interval $[0, 2\pi]$ for which $2\tan^2(x) - 1 = 5$.

[3]

Question 9: Let $f(x) = x + \dfrac{1}{x}$ and $g(x) = \dfrac{x+1}{x+2}$. Determine and simplify $(f \circ g)(x)$ and state the domain.
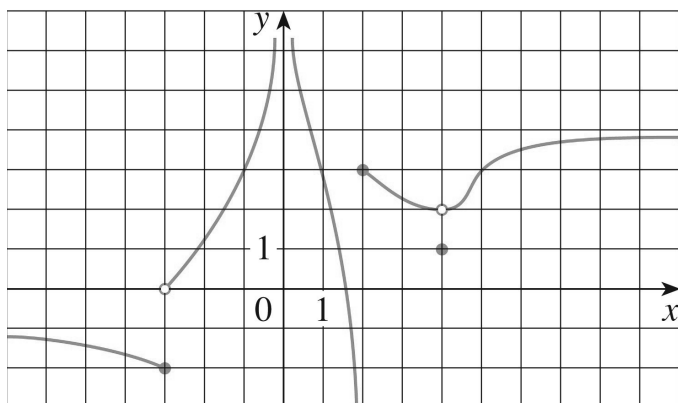
[4]

Question 10: Evaluate and simplify the difference quotient $\dfrac{f(a+h)-f(a)}{h}$ where $f(x)=\dfrac{x}{x+1}$. Express your answer as a single simplified fraction.

[4]

Question 11: Suppose $H(x)=\dfrac{1}{x+\sqrt{x}}$. Find functions $f(x)$ and $g(x)$ so that $H(x)=(f\circ g)(x)$. Do not let $f(x)=x$ or $g(x)=x$. (There are many possible correct answers.)

[3]

Question 12: Consider the following graph of $y=f(x)$:

Let
$$a=\lim_{x\to-3^-}f(x)$$
$$b=\lim_{x\to4}f(x)$$
and
$$c=f(4)$$
Determine $a+b+c$.

[3]

Question 13: Evaluate the following limits, if they exist:

(a) $\displaystyle\lim_{h\to 0}\frac{\sqrt{5h+4}-2}{h}$

[4]

(b) $\displaystyle\lim_{x\to -2}\frac{x^2+x-2}{x^2+7x+10}$

[3]

(c) $\displaystyle\lim_{x\to 1}\frac{\left(\dfrac{1}{x}-1\right)}{x-1}$

[3]