Answer Key

1 $p < -9$, $p > -1$

2 Simplify to $17(4^x)$

Since 17 is a factor, the expression is divisible by 17

3 $\frac{d^2y}{dx^2} = 50x^{-2}$

(2.5, 20) is a min point, (–2.5, –20) is a max point

5 Area = 26 sq units

6a) P(–4.5, 0) Q(–1.5, 6) R(1.5, 0)

6b(i) One Solution. The line $y = 2x - 1$ is parallel to one part of the graph $y = 6 - |2x + 3|$ and the y-intercept of $y = 2x - 1$ is below the max point of $y = 6 - |2x + 3|$. Hence, the two graphs will only interest at one point.

6b(ii) Two solutions.

The line $y = -½ x - 1$ is not parallel to both parts of the graph $y = 6 - |2x + 3|$ and the y-intercept of y = = $-½ x - 1$ is below the max point of $y = 6 - |2x + 3|$. Hence, the two graphs will interest at two points.

7(i) –1 (ii) $x^2 - x + \frac{27}{8} = 0$

8 45°, 108.4°

9(i) $a = 3t^2 - 8t$; 3 m/s^2

9(ii) at rest, v = 0, t = 4 (iii) $5\frac{1}{3}$ s

9(iv) Total distance = 32.25 m

10(i) a = 10, b = –2

10(iii) (2, 0)

11(i) $A = 2x^2 + 4x(1000/x^2)$

11(ii) 3/140 cm/s

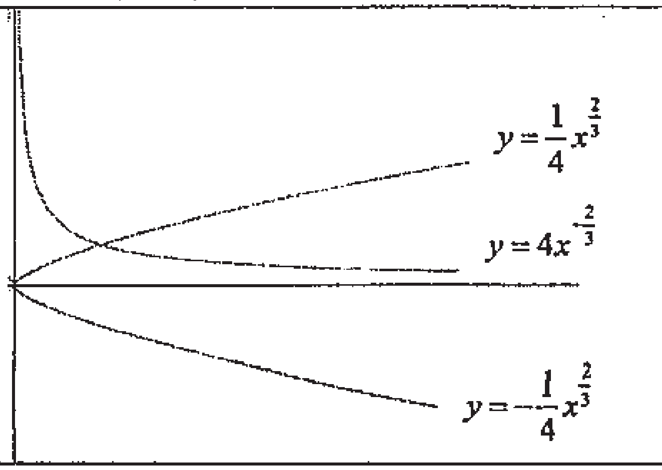
12(i) Min level = 2 – 2(0.8) = 0.4 m (ii) c = 2 – 0.8 or c = ½ (2+0.4)

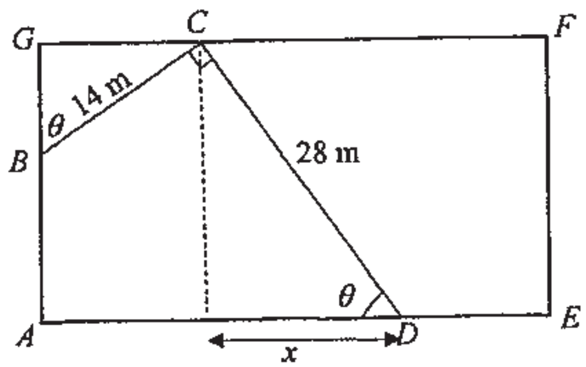
12(iii) k = π/10 (shown) (iv) $\frac{\pi}{10}t = \pi - 0.35542, \quad \pi + 0.35542$

$t = 8.869, \quad 11.131$

Between 16 53 to 19 08

Peicai Secondary School
Preliminary Exam 2019

1i	$4nx$
	$\frac{n(n-1)}{2}(16x^2)$
	$8(4n)=\frac{n(n-1)}{2}(16)$
	$n(n-5)=0 \qquad n=0$ (rejected)
1ii	$163+20p$
1iii	$163+20p=263$
	$p=5$
2i	$(\cos 3x)\left(\frac{d}{dx}(x)\right)+(x)\left(\frac{d}{dx}(\cos 3x)\right)$
	$\cos 3x=-3x\sin 3x$
2ii	$\frac{1}{3}\int(\cos 3x - x\cos 3x)dx$
	$\frac{\sin 3x}{3}$
	$\frac{1}{9}\sin 3x-\frac{1}{3}x\cos 3x+c$
2iii	$\left(\frac{1}{9}\sin\pi-\frac{1}{3}\left(\frac{\pi}{3}\right)\cos\pi\right)-\left(\frac{1}{9}\sin 0-\frac{1}{3}(0)\cos 0\right)=\left(0-\left(\frac{\pi}{9}\right)(-1)\right)-(0)=\frac{\pi}{9}$
3i	$\frac{(x^2+1)(2x)-(x^2-1)(2x)}{(x^2+1)^2} = (x^2+1)(-1)(x^2+1)^{-1-1}(2x)+(x^2+1)^{-1}(2x)$
	$=\frac{4x}{(x^2+1)^2}$
3ii	$x=-1$ or $x=1$
	$y=x-1$
	$y=-x-1$
3iii	$4x>0,\ (x^2+1)^2>0 \ \rightarrow\ f'(x)>0$ Hence f(x) is increasing
4i,ii,v	
4iii	Reflection in the x – axis

4iv	$\frac{1}{4}x^{\frac{2}{3}} = 4x^{-\frac{2}{3}}$ $x^{\frac{4}{3}} = 16$ (8, 1)
4vi	$\frac{1}{6}x^{-\frac{1}{3}} = -\frac{8}{3}x^{-\frac{5}{3}}$
	When $x = 8$, Product of the gradients $= \frac{1}{12} \times -\frac{1}{12} = -\frac{1}{144}$ Since $m_t m_n \neq -1$, Tangents are NOT perpendicular.
5	
5i	$x = 28\cos\theta$
	$GC = 14\sin\theta$
	$AD = 14\sin\theta + 28\cos\theta$
	$\text{T} = 53 + 14\sin\theta + 28\cos\theta$
5ii	$\sqrt{28^2 + 14^2} = \sqrt{980}$ or $14\sqrt{5}$
	$\tan^{-1}\frac{14}{28} = 26.6°$
	$\text{T} = 53 + 14\sqrt{5}\cos(\theta - 26.6°)$
5iii	$\cos(\theta - 26.565°) = \frac{25}{14\sqrt{5}}$, $\theta = 63.6°$ $\theta - 26.565° = 37.0037°$
5iv	$\frac{1}{2} \times EF \times (5 + 2\sqrt{5}) = 45 + 42\sqrt{5}$
	$EF = \frac{2(45 + 42\sqrt{5})}{(5 + 2\sqrt{5})} \times \frac{5 - 2\sqrt{5}}{5 - 2\sqrt{5}}$
	$\text{EF} = 48\sqrt{5} - 78$
6i	$(x-4)^2 + (y-2)^2 = 13$
6ii	$AR = \sqrt{17}$
	Since AR > $\sqrt{13}$, Point R lies OUTSIDE circle
6iii	$(x-4)^2 + (0-2)^2 = 13$
	$x = 7, x = 1$ $\left(\frac{7+1}{2}, 0\right)$ (4, 0)

6iv	4
6v	$(4-7)^2+(y-0)^2=18$ or $(4-1)^2+(y-0)^2=18$
	$y=3$ or $y=-3$(rejected) Centre = (4, 3)
7b	19.5°, 160.5°
7c	2.42, 3.86
8i	$h(x)=\frac{6x^2-21x+25}{2x^2-5x}$
8ii	By long division $6x^2-21x+25\div\left(2x^2-5x\right)=3$ Remainder $-6x+25$ or $a(2x^2-5x)+bx+c=6x^2-21x+25$
	$\frac{-6x+25}{2x^2-5x}=\frac{A}{x}+\frac{B}{2x-5}$ A= −5, B = 4
	$3-\frac{5}{x}+\frac{4}{2x-5}$
8iii	$\frac{2}{2x-5}$
8iv	$3+\ln\frac{2187}{1024}$
9a	$r=m-3n$
9bi	$x=2\frac{2}{5}$
9bii	$y=0.585$ or $y=5$
10i	$P=(5,\frac{5}{4})$
10ii	$\frac{9}{(7-x)^2}-1=0$
	$x=4$ or $x=10$ (rejected) $Q=(4,0)$
	Equation of AP is $y=\frac{9}{4}x-10$
	$x=\frac{40}{9}$ $A=(\frac{40}{9},0)$
	Area of triangle = $\frac{25}{72}$
	Area of shaded portion = $\int_4^5\left(\frac{9}{(x-x)^2}-1\right)dx-\frac{25}{72}$
	$\frac{11}{72}$

12